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FIRST PART
ORIGINAL ARTICLES

Note on cocoa growing in the State of Bahia (Brazil)

by

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In Brazil the cocoa tree is indigenous and grows in the shade of the est which covers the banks of the river Amazon and of certain of its tributaries, where it has its natural habitat. Even to the present day, it is seen wild in Pará and Amazonas, the most northerly States of Brazil. The Spaniards after having learned from the Mexicans the use of chocolate found it to their taste, commended the exportation of cocoa beans to Spain; this export has been the cause of much fighting and smuggling. The Portuguese, to whom nature had given so valuable a tree without need of cultivation, turned their eyes to its fruit. Cocoa began to be sent to Lisbon from Pará, at that time the chief town of Capitanía, the administrative division of colonial Brazil, which controlled the whole of Amazonia. Only the fruit of wild trees found on the banks of the rivers was collected and restrictions were not made because of the savages who inhabited these countries.

In 1678 a "Carta Regia" (Royal decree) ordered regular cultivation and this preliminary regulation was followed by others granting bonuses and reductions of duty on cocoa produced on regular plantations. The production of the cocoa plantations and that of the wild trees reached fairly high figures for the period: in 1778, it was 902 tons and, in 1818, 1524 tons. In Bahia cultivation is said to have begun in 1746, from seed brought from Pará by the French planter Louis Frédéric WARNEAUX. The seed was sown at Cubículo on the banks of the river Pardo, in Canaieiras, by Antonio Dias RIBEIRO. The Portuguese Government took interest in the cultivation and by its agents, known under the title

of "Conservadores das Florestas" (Conservators of Forests), tried to assist production. Reference may be made to the speech of FERREIRA DA CAMARA, one of these Conservators, at the Academy of Sciences at Lisbon, in 1789, in which he started a propaganda in favour of the cultivation of cocoa in Bahia and stated its advantages and profits. It is even said that the introduction and plantation of cocoa trees in Bahia was due to his efforts. In 1779, there were cocoa trees at Rio de Contas and at Cayri and in 1802 at Santarem the people cut down the trees "for they were of no use to them."

Von MARTIUS said in 1819 that the cultivation had had a successful beginning, but that at that time it was almost non-existent and that one could see at Camamu trees which proved that the region was favourable for them. It was only in 1820-1822 that it was introduced at Ilheus. Pierre WEYLL and his companion SANARAKER having obtained a "Sesmaria" (land granted by the king in perpetuity) in 1818, brought in German planters on two occasions, to colonise this land. At that time people were interested in the cultivation of sugar cane and coffee, but the cocoa tree was also planted; old cocoa trees of this first plantation by the Germans are still shown at Provisão. That plantation was the nucleus of the cultivation at Ilheus. In 1778, the export of cocoa from Bahia was 900 kg.; cultivation developed slowly and in 1835 the export reached 26 805 kg. The statistics show the increase of exports which continue to grow yearly. It was not until after 1890 that the cultivation made a great advance owing to the high prices given for cocoa.

At that time the export from Bahia was 3 502 tons and that of Amazonia 3 387; in 1900, the export from Bahia had risen to 12 131 tons and that of Amazonia did not exceed 3 085 tons. Amazonia, which was the principal producing State, gave place to the State of Bahia, which at present yields 90 % of the Brazilian export and by itself occupies the second place in the world's statistics for countries producing cocoa. The growth of cocoa is the most valuable product in the State of Bahia and accounts for 25 % of the Budget receipts.

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The cocoa plantations in Bahia occupy the southern part of the State, from the mouth of the river Jequiriçá to the boundaries of Espírito Santo. This area has an extent of over 500 km. along the coast and varies in width from some ten to more than 100 km., and possesses the conditions required for the crop.

In some parts planting is not possible and generally the land near the sea must be left out. In certain places planting is done near to the sea; in others it is necessary to go inland to avoid sandy soil and wind.

In this area plantations are not regularly distributed; they are grouped around centres, sometimes separated by long stretches of virgin forest, while others continue without interruption over large districts.

The producing centres may be divided into three groups:— the first

high stretches from the river Jequiriça to the river Una, in which are found some important centres such as Jequié, Rio de Contas and Ilheos, the largest of all the districts; the second, which is situated on the banks of the rivers Jequitinhonha and Pardo; the third formed of isolated plantations. A river and its tributaries always form the centre of radiation of plantations. In the first group, the plantations are made on the banks of the rivers and numerous streams, on the hills, on their slopes, in the intermediate valleys, in short wherever the cocoa tree seems able to grow. In the second group, the plantations are made on the banks of the rivers, on the rich alluvial plains, often inundated by high floods, for which reason new plantations are made on higher ground. The third group shares the conditions of the first two. The difference between the first two groups is also shown by the quality of the produce. The cocoa coming from Belmonte and Cannavieiras, of the second group, is better prepared and of better quality, and in Jequitinhonha are found the best equipped and best cultivated plantations.

The first group on the contrary, although it produces good cocoa, and has good plantations, is divided up into small farms under numerous proprietors who cannot give the produce the necessary care. This group, which are Ilheos, Rio de Contas, Jequié, Santarem, Camamu and Una, supplies almost 75 % of the total output of the State of Bahia. The centres of production are called after the names of the communes or the ports of shipment, as, for example, Ilheos, which controls the produce of two communes:— Ilheos and Itabuna. Except Jequié, which makes use of the Nazareth railway for transport, all the producing centres ship from the ports up to Bahia. There are as many as 24 communes in which the cocoa tree is planted, but some of them are unimportant, either because planting is decreasing and is being replaced by other crops or because planting is in the experimental stage.

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The characteristics of the region in which cocoa trees are planted are:— regular rains, even temperature, humid atmosphere, presence of tropical forest, soils rich in humus or fertilising matter. Over so large an area, these conditions certainly vary, but on the whole, they are not notably modified. There are no great mountains in the whole of the area occupied by planting, but only low hills not over 300 m. in altitude. The plantations do not reach to more than half this height.

The cocoa tree can give good results at greater altitudes, but the transport of the crop would be difficult and as there is plenty of land, hills at a certain height form the future reserves. The rainfall averages 1800 mm. and falls every month. No month can be said to be wetter than another, as the distribution varies each year; but at Ilheos it may be said that the wettest months are from December to May and that the dampest and coldest months are from June to September. There was a great drought in 1920,

but the only consequence was a decrease in the crop of the following year, and the trees have not suffered.

The humidity of the atmosphere is great, and often, during the night and early hours of the day, fog covers the plains, the savannahs and even the hills. The average temperature is from 25 to 27° C., the maximum 33° and the minimum 14°. Temperatures of 33° are recorded on very sunny days, followed by a drop to 18° the next morning.

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The soils on which cocoa is planted are generally very good, rich in fertilising matter and covered by dense tropical forest. Analyses have not been made and the composition of these soils is not known, but analyses would show that they possess good qualities. On the banks of rivers, in the plains and in the deep valleys between the hills, soils are found with deep beds of decomposing vegetable matter. Sandy loams and clay soils are most common and are those on which most of the plantations are made. On the slopes of the hills, very fertile, clay soils are formed by the decomposition of the primitive rock. Granitic soils are also met with, on which the forest trees grow well: these soils are also very good for cocoa. The rock should not be compact, and should be in blocks with interstices through which the roots of the cocoa tree penetrate, and the subsoil should not be formed of horizontal strata. Plenty of plantations on such soils and giving a good yield can be seen at Ilheos. At Belmonte and Cannavieiras, the predominating soil is of the humus type on the banks of rivers in the alluvial plains of the basins of the rivers Jequitinhonha and Pardo. In the other producing centres, good alluvial soils are also found, but clay soils predominate.

With the exception of Cannavieiras and Belmonte where the soils are better chosen and prove more fertile, planting is done without much regard to the conditions of the soil. It is only on sandy soils, in places where compact rock is met with, or else hard clay-sandy soils, or places where water accumulates and forms permanent marshes that no planting is done. It is certain that with this procedure, good crops will not be obtained, that the average production will be much lowered and that soils of poor quality should not be chosen while there are good soils from which to select.

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Neither the number of trees nor the area cultivated are known but only estimated. According to such estimates, the area covered by plantations is 104 200 ha., on which are planted 103 300 000 trees. There are about 5 800 000 young trees not yet in bearing or bearing very little, and about 97 500 000 trees in full bearing, old trees yielding very little and trees temporarily useless because of disease or the effects of floods, etc. The trees which no longer bear fruit are not included.

These figures are approximations only and the author hopes to make fresh investigation to verify them. If the parts be included which are till unplanted, where there is forest, pastures and other crops, the area may be doubled and the area occupied by cocoa cultivation will thus be found to be nearly 210 000 ha.

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Three kinds of cocoa trees are planted in Bahia, known under the local designations of Common Cocoa, Pará Cocoa and Maranhão Cocoa.

The Common Cocoa, which may be classed in the "Amellonado" type of Van HALL, has large, wrinkled fruits, almost cylindrical in the middle and narrowing at both ends. The tree grows more in height than in breadth and the leaves are of medium size, rounded at the base and undulate between the nerves. The beans are of good size and less flattened than those of other kinds. It requires more care in cultivation than the other varieties and only gives satisfactory results on soils of good quality and when sheltered from the wind. Under good conditions this species yields well and lives a long time, but is later before beginning to bear than the others.

The Pará Cocoa, which may be classed under Van HALL's "Callabacillo" type, has rounded fruit, with a smooth, thin shell. The beans are very flattened and the leaves are longer and thinner than those of the Common Cocoa. It does not require good soils and grows more rapidly than the other kinds and has a tendency to develop more in breadth than in height but is very sensitive to lack of moisture. It appears that this kind is the result of hybridisation between the Common Cocoa and the Maranhão Cocoa.

The Maranhão Cocoa resembles the Common Cocoa in having slightly longer and larger fruits than those of the Common Cocoa, the fruits are as wrinkled or even more so than the latter, and the tree grows more in breadth than in height. The beans are less flattened than those of the other two kinds. Its root system is more superficial, which makes it suitable for shallow soils.

Hence, it may be concluded that the Common Cocoa should be preferred for good deep soils and that the others should be planted on poorer quality soils. At Belmonte and Cannavieiras planters prefer to grow the Common Cocoa and at Ilheus the two other kinds.

With regard to yield, it appears that the Common Cocoa fruits more regularly and more abundantly; the other kinds have high yields, followed by a decrease, and do not maintain a steady production.

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The yield per tree and per hectare is very variable: planting is done at various spacings, from 625 up to 1000 trees per hectare. The kind planted and the quality of the soil cause variations in the yield per tree. At

Belmont and Cannavieiras, the average yield of a tree may be estimated at 750 grammes and at Ilheos at 650 grammes, figures which must be reduced for the other centres. The production per hectare may vary from 540 to 1200 kg. and yields of 2000 kg. per hectare and 4 kg. per tree have already been obtained.

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The cocoa tree is almost always planted in virgin soil in places previously under forest.

For this the forest is completely cut down, the felled timber is burnt and the ground is prepared by cleaning up the debris left by the fire. Generally planting is not done for some months after the cleaning, as felling is done in the dry season and planting when there is rain. The native vegetation of the ground is a guide to the planter as regards the quality of the soils, and the growth of certain trees is also a good indication. After the ground has been prepared the places where the cocoa beans are to be planted are marked by means of stakes 1.30 m. in height. Before planting the cocoa trees, temporary shade trees are planted, generally manioc or bananas, and a few months later the planting of cocoa trees is begun. The distance between the stakes, and consequently between the trees, varies from 3 m. to 4.25 m. in new plantations, while in the old plantations it was as little as 2 m. The kind of cocoa tree planted also determines the distance; for the Common Cocoa planting must be closer, as it grows more in height than in breadth.

The usual method is to plant three beans round the stake; as the young plants which spring up are allowed to grow there is often a group instead of a single tree. In Bahia shaded cultivation is not practised and for this reason trees are not planted for permanent shade; after the temporary shade is withdrawn, fast growing trees of the secondary forest which grows up after the old forest is felled, are used for the young cocoa trees. In course of time the trees cover the space with their branches, and shade the whole ground at which time it is said that the plantation has "closed up". The plantations are formed by means of clearings opened in the forest called "roças", having a variable number of cocoa trees (up to 5000). The "roças" are separated one from another by zones of trees of the original forest; a collection of "roças" forms a "fazenda", which is a variable number of small plantations separated by large trees. These trees serve as protection against wind and the sun.

These zones of trees are now being removed in order to join up the "roças" and large extents of cocoa trees without any shade may be seen. So long as the plantation has not "closed up", which happens in the fifth year, the cocoa plants must be freed from weeds and vegetation which grows vigorously; weeding is made 3 or 4 times a year. After the plantation has "closed up," it is only necessary to weed from time to time as the shade prevents weeds from growing.

The care given to cocoa trees is limited to cutting a few dead branches.

adventitious branches and to freeing them of parasitic plants. No regular pruning is done and almost all planters are against it. Many planters pay more attention to the trees, but nowhere can it be said that the culture is scientific and methodical, or that the attention necessary to obtain the highest yield is given owing to the fact that with present methods and current prices, good profits are obtained. The lack of experimental stations (which are non-existent) and of experts to give practical instruction and show the planters the advantages of intensive cultivation causes the planter to be guided by experience and tradition, and the cultivation to be maintained almost in its primitive state.

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The cocoa tree begins to bear fruit from the fourth year for the Pará and Maranhão kinds and from the sixth to the seventh year for the Common cocoa. The first fruits are few in number and scattered on the trees which should not enter into full bearing before the eighth year. However it bears some fruit, so that the plantation from the beginning gives a return to the planter for which reason the early fruiting species are usually grown.

The plantation is made either by the proprietor himself, or by labourers with whom he makes a contract. Under this procedure, the contractor takes possession of the ground, fells the forest, plants the cocoa trees, uses the land for his catch crops, and, at the end of the time arranged, receives in payment a sum previously agreed on for each tree planted. This is one of the reasons why cocoa cultivation is done with little capital or, more correctly, with the sole labour of the small planter.

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The cocoa tree bears fruit all the year round; the fruit ripens in May in small quantities, and the yield increases up to July, when production is almost suspended; the crop of the early months is called "temporã", this preliminary crop is followed by the regular crop, "safra", which lasts up to April, when it ends. The months of full bearing are generally from September to January, and in Bahia the crop years are counted from May to April.

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When the fruits turn yellow they should be gathered, which is done by means of bill hooks fitted on to long poles. The fruit which falls is collected into heaps and opened with large knives and the beans are extracted by hand. The cocoa beans are then taken to the fermentation houses. The methods of harvesting differ very little in the various countries.

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Fresh cocoa (called "soft cocoa"), when it reaches the fermenting house, is placed in depots called "cochos". These are wooden boxes measuring about 1 m. in height, 1 m. in width and 5 to 8 m. in length. Some planters use boxes with small holes bored in the bottom for the escape of liquor formed during fermentation, others prefer them quite water-tight. Good results are obtained with both systems. During fermentation the cocoa is covered with banana leaves, sacks, etc., and is turned over every day. Fermentation is more or less rapid according to the quality of the cocoa and the state of the weather and lasts from five to eight days.

Experience is necessary to judge when the fermentation process is ended.

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When fermentation is over, the cocoa is taken out of the "cochos" for drying. Drying is generally done in the sun on wooden floors which can be covered with a corrugated iron roof to protect them from rain. These drying places vary in dimensions according to the requirements of the plantation and are of two types:— 1) "Balcons", super-imposed moveable floors on rails at different levels, having a single common cover; 2) "Barcaças", formed of a single fixed floor, the cover running on rails. The first type is much used at Cannavieiras and Belmonte, and the latter at Ilheos. Drying places with artificial heat, called "estufas" are also used, they are constructed in different ways, but based on the same principle. These drying places consist of a structure, into which a truck with several drawers of perforated tin is run and a heated chamber. At Belmonte a dryer of the "Guardiolo" type is in use, and another type with mechanical movement is installed at Ilheos. These dryers all have defects and no agreement exists at present as to which is the best type. The best cocoa is obtained by drying in the sun. Drying lasts for three to eight days, and should be done slowly so that the cocoa may dry completely.

To give the cocoa a shining appearance, it is subjected in the dryers, while still moist, to "pisagem"; an operation identical with "dancing" in Trinidad: barefooted men collect the cocoa in small heaps on the drying places and tread on the beans for about an hour; when it is over the cocoa continues to dry and, when quite dry, it has a polished shiny appearance.

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The cocoa when quite dry is taken to the warehouses where it is weighed and put into sacks. At Cannavieiras and Belmonte transport is by river in "canoas" (canoes) up to the shipping ports. In other centres donkeys are used forming "tropas" (collection of several donkeys under control of one or more men). To reach places where transport is easier, that is to

say either a navigable river or a railway station, the "tropas" travel by very rough paths. The dangers, accidents in crossing streams and marshes where the animals sink up to their necks and sometimes fail to get out, the passage through the forest and the descent of hills where the paths follow the slope directly, make transport difficult and reduce the quality of the cocoa. As soon as the cocoa reaches its destination or the shipping ports, it is classified under commercial types in the warehouses of the big merchants, and made up in large lots and mixed in order to render it more uniform. The cocoa is then packed in bags of 60 kg. and shipped either on sailing ships or small steamers which call at the various ports. Almost all the cocoa is sent to Bahia, whence it is despatched to foreign countries. During the war shipping was done at Ilheus for Rio de Janeiro, where transshipment was made to transatlantic vessels; it is for this reason that the statistics from 1914 to 1919 indicate a great increase in the export of cocoa from this port. At present small quantities are sent from Canavieiras and Ilheus to Rio for local consumption. Bahia is the market and port of despatch for cocoa of the State of Bahia.

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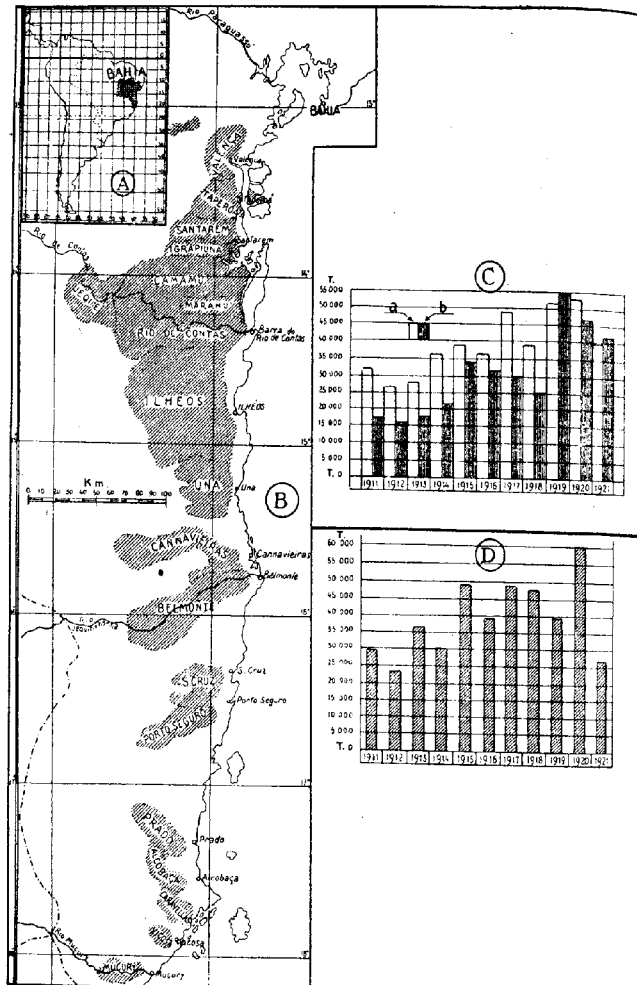
On the market, cocoa is classed under three kinds:—"Superior", "Good Fair" and "Fair". The "Superior" cocoa is shiny, dry and without external defects and has an odour like chocolate; when cut, not more than 2 to 4 % of internal defects are found. The "Good Fair" should have the same qualities on a smaller scale and not more than 8 % of internal defects. The "Fair" is badly prepared cocoa, of poor appearance and in which the defects are as high as 25 % or more. Local purchases are made per *arroba* of 15 kg. and, at Bahia the accounts of the brokers are passed for quantities of 10 kg. Exporters make their offers on the basis of 50 kg. but shipments are made in bags of 60 kg. net.

The difference in price between the kinds is variable and has reached as much as 2\$ (3 francs at the rate of exchange). The price in the Bahia market is also very variable, but the average, for the past few years, has not fallen belows 12\$ (12 *milreis*) for 15 kg., and the market depends on the prices in the New York market.

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The estimates of the net cost of a plantation are too long to be shown, but it may be said that a cocoa tree costs from 2\$500 to 3\$ (4 to 5 francs) everything included:—cost of land, staking out, planting and maintenance for five years. For plantations which have drying installations 4\$ per tree is calculated, the price 30 *contos* per 1000 *arrobos* of production (50 000 francs for a production of 15 000 kg.) is taken as a basis for the purchase of a plantation. The cost of harvesting, preparation and drying the cocoa is small and we may calculate 250 *reis* (40 centimes) per kg. or 2\$250 per 15 kg. at the plantation. If the calculation is made to include transport to the

EXTENT AND PRODUCTION OF COCOA CULTIVATION IN THE STATE OF BAHIA.



EXPLANATION.

- A = Situation of the State of Bahia in Brazil.
- B = Extent of Cocoa cultivation in the State of Bahia.
- C = Export of cocoa from the State of Bahia :—
 - (a) in tons ;
 - (b) 1 mm. corresponds to 2000 *contos de reis* (2632 fr. at par).
- D = Cocoa production of the State of Bahia, in tons.

TABLE I. — *Export and crop yield of cocoa of the State of Bahia, Brazil.*

Years	Exports				Principal Crop (+ Safra -) bags of 60 kg
	Foreign		Brazil		
	tons	milreis	tons	milreis	
1911	3 1447.995	17 059 460	315.463	175 915	493 217
1912	26 687.784	15 364 479	343.479	399 633	384 780
1913	27 950.049	17 787 704	437.406	298 791	612 494
1914	36 457.274	21 608 284	770.439	454 835	496 644
1915	39 004.236	34 253 360	1 224.528	996 239	820 335
1916	36 249.345	31 459 294	2 723.876	2 398 646	652 795
1917	48 489.102	30 013 235	1 655.180	1 114 528	814 512
1918	39 097.325	25 088 573	2 376.718	1 470 477	799 411
1919	51 312.022	54 902 917	650.213	669 475	660 541
1920	52 260.701	46 497 751	755.376	772 031	1 005 169
1921	39 575.778	41 890 516	358.000	378 776	436 732

1 milreis = 2.832 fr. *at par*.TABLE II. — *Extent of cocoa cultivation in Bahia (estimates).*

Cocoa trees in production	Young Cocoa trees	Total Cocoa trees	Area planted
97 500 000	5 800 000	103 300 000	104 200 ha

TABLE III. — *Imports of Bahia cocoa (in tons)
into the principal importing countries, from 1911 to 1921.*

Years	United States	France	Great Britain	Germany	Holland	Argentina
1911	7 180.210	4 670.878	7 012.977	10 338.341	944.065	961.930
1912	6 567.691	4 287.221	8 687.347	6 038.666	394.669	1 034.751
1913	10 300.772	3 294.988	10 330.652	2 469.246	119.710	1 041.788
1914	11 153.694	4 142.610	11 624.814	5 941.413	465.269	579.826
1915	13 976.522	5 375.127	6 558.286	—	4 392.588	985.106
1916	13 921.687	12 671.287	5 262.339	—	2 236.614	1 261.328
1917	32 136.049	7 528.519	4 563.695	—	1 197.619	1 150.831
1918	26 004.668	5 451.142	3 003.088	—	—	3 069.758
1919	32 135.902	6 302.093	2 821.410	2 400.000	1 607.106	1 156.852
1920	26 854.192	6 279.580	299.596	6 674.980	4 385.004	2 155.270
1921	16 389.000	1 078.000	162.000	8 693.000	3 225.000	1 739.000

warehouses of the buyers at ports of shipment the cost per 15 kg (1 *arroba*) would be from 4\$500 to 5\$ (7 to 8 francs) an amount which, with the transport to Bahia, would amount to 6\$500 — 7\$. The present average price is 16\$ per 15 kg. and it is evident that the planter has a margin to cover the cost of upkeep of the plantation, which is very small, and to pay interest on the invested capital. This capital, that is to say the capital invested in cocoa planting in Bahia, allowing that the value of a cocoa tree in 3\$ and that the estimate of the number of trees is correct, is 310 000 *contos*, or, at present exchange, 516 000 000 francs.

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The State of Bahia imposes duties amounting to 19.5 % of the commercial value on cocoa exported either to foreign countries or to other States of Brazil. The average of the market prices during a fortnight is taken and this average is fixed as the value for the next fortnight. The Communes also tax the cocoa which crosses the limits of their territories to the extent of 250 to 200 *reis* per 15 kg. The State taxes are calculated at Bahia, where the cocoa arrives already burdened by the cost of transport, etc. and in consequence taxation exceeds 25 % of the value of the produce in the producing centres.

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The cocoa tree in Bahia has also its diseases, caused either by fungi or by animals, but they are neither very important nor serious in character. With cultural attention and supervision in the most infested countries the diseases will disappear. At Ilheus in 1919 trees were damaged in some districts and looked as if they had been burnt. A Commission studied the matter and ascertained the presence of *Thrips*, "mosquilla" and other injurious insects. Without any remedy other than the rain, which had previously been deficient, the trees regained their former appearance and bore well. It is always necessary to be on the look out, for the germs of disease are there and at any time there might be a serious outbreak. In principle, it may be said that diseases of the cocoa tree do not exist to such an extent as to endanger production and local conditions do not favour propagation of disease and that the trees are resistant to their pests, but care is always necessary (1).

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The cultivation of the cocoa tree is still progressing in Bahia; fresh plantations are made in the principal producing centres, but not to such an extent as to cause a great increase in production. As one gets away from the shipping centres and transport has to be done over considerable

(1) See *R. April* 1918, No. 493. (*Ed.*)

stances, by roads which are impracticable when it rains, the crop scarcely pays the cost of transport and does not give the planter a profit. Labour also is insufficient and the casual labourers who used to come from the north of the State no longer do so. These two factors, viz., difficult transport and want of labour, are the principal causes which prevent expansion. There are also the old plantations, trees attacked by disease, those which, owing to bad upkeep have become almost useless, those damaged by floods, and in short all the plantations which bear little or nothing and it will be seen that no great increase of production is to be expected. In the writer's opinion, during the next five years, crops exceeding an average of 850 000 to 900 000 bags of 60 kg. per annum cannot be counted on. Progress of the crop depends mainly on transport, the cost of which must correspond with the market prices of the product. The planter ought not to pay for transport almost the value of the product. If railways cannot be constructed, roads for transport animals would be sufficient, provided that they are well maintained. Localisation of labour would be a second requirement to do away with casual labour which is often lacking and hence causes wages to increase. Lastly Government measures are wanted for the protection of planting by laws giving prizes for good produce, prescribing the construction of roads, decreasing the export duties on cocoa, facilitating the acquisition of land and guaranteeing the rights of the first occupier, keeping good order and not permitting injustice, founding experimental Stations and instruction by agricultural officers in the producing centres to teach good methods, intensify rather than extend the cultivation, demonstrate the advantages of good product, in short to cause the cultivation to pass from the present primitive state to a state of scientific and methodical cultivation. Once these measures are taken, great progress may be expected in cocoa cultivation, and such measures are absolutely necessary to enable cocoa to withstand a fall in price which may be expected in view of the increase in the world's production, the protective measures taken by other countries and the rate of Brazilian exchange, at present very low but which may rise at any moment. It is certain that at the present time this planting gives good profits and remunerates in a fairly satisfactory manner the capital invested; and the writer strongly recommends the employment of capital in the purchase of plantations already bearing. It is not reasonable that people should borrow capital at excessive rates of interest, and hope that the planting will provide for this interest, pay off the capital and in addition allow the planter a good income.

Cocoa-planting in Bahia offers excellent prospects for the investment of capital, provided that care is taken to select a plantation in good condition; with sound, economical management such a plantation would undoubtedly return a satisfactory income. The fall in the Brazilian exchange makes the present time very favourable for such investments.

SECOND PART
A B S T R A C T S

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

RURAL
HYGIENE

1010 - **Action of Vitamines.** — MITCHELL, H. H. (College of Agriculture, University of Illinois) in *Science*, Vol. 56, No. 1437, pp. 34-37. Utica, N. Y., July 14, 1922.

The discovery that small amounts of certain substances of undefined chemical composition are necessary constituents of a complete diet has opened up a wide field of research. Experiments have been made with animals by supplying them with rations deficient in certain vitamins. The study of vitamin A has been made with rats, vitamin B with pigeons; vitamin C with guinea pigs and monkeys. The results are consequently not always applicable to other cases; for example foods deficient in vitamins A, B and C for the animals in the experiment may contain sufficient for the requirements of human beings and domestic animals.

Although large amounts of meat or meat extract will not adequately protect guinea pigs from scurvy, in the case of human beings, even a relatively low concentration of the vitamin in meats will prevent an out-break indefinitely. In the case of human requirements, therefore, fresh meats should not be considered deficient in vitamin C though such is the case with the guinea pig.

For this reason it is premature to generalise from the results so far obtained; for example, milk and butter have a high growth vitamin or liposoluble A content, which may be entirely lacking in the case of hydrogenated fats or vegetable oils and this fact is made use of in arguments against the employment of these oils. It is very doubtful, however, whether such foods are deficient in vitamins from the human standpoint to such an extent that it is necessary to replace them by others which are richer in these substances.

On the other hand probably the functions of the growth vitamin are confined to the period of active growth; adult rats have been maintained in good health for over a year on rations devoid of this vitamin.

At the Illinois Agricultural Experiment Station, 4 sows have successfully raised in less than one year, two litters of pigs each, although the

ration, according to the tests with rats, was nearly if not entirely deficient in vitamine A.

The theory of vitamins may also be exaggerated in other ways.

The English Medical Research Committee for instance states in a recent report that a deficiency in vitamine may be responsible for ill-health, but such a statement is based on conjecture and probability and ought not to be accepted as a fact. The part played by vitamins is at present hypothetical and views respecting food requirements of human beings and animals which are merely based on hypotheses ought not to be accepted without due consideration.

L. V.

511 - Influence of the Weight and Size of Seeds on Yield. — DESPREZ, F., in *Journal d'Agriculture pratique*, Year 86, No. 7, pp. 141-143. Paris, Feb. 18, 1922.

It has always been admitted that the largest and heaviest seeds gave the best cultural results.

VARRO, COLUMELLA, PLINY and in more recent times OLIVIER DE SERRES, P. JOIGNEAUX, SCHRIBAUX, etc. have recommended this mechanical selection for obtaining the most vigorous plants and the greatest yield. Some agriculturists however have attributed but slight importance to these characters of the seed. Thus, the Belgian agriculturist DE CALUWE published a pamphlet in 1908 in which he set out the results of experiments carried out at the "Jardin d'Essais" at Ghent with oats and barleys which were unfavourable to large seeds. Further, basing his conclusions on tests made by JANNESON, of the Glasterberry Station in Scotland, by TH. REMY, of the Agricultural College of Bonn-Poppeldorf in Germany, and others he came to the conclusion that the results of practical and carefully arranged experiments tended to negative the superiority of large heavy seeds.

The writer refers to some experiments made by him since 1896 at the Agricultural Experimental Station of Cappelle (Nord) with 5 varieties of wheat sown on 5 plots of an area of 20 ha. each; one half of each plot was sown with large seed and the other with small. The superiority of the large seeds, so far as the yield of grain calculated by weight was concerned, was evident and in some cases very marked. The difference was greatest in the case of a yellow bearded wheat for which the large seed gave a yield of 4800 kg. per ha. and the small seeds a yield of 3898 kg., a difference of 902 kg. per ha. For the other varieties, the difference, though less marked, was still considerable (kg. 125 — 275 — 282 — 367). The specific gravity of the grain (weight of 1 hl. expressed in kg.), was the same for two varieties and for the other three, that of the large grain was slightly greater than that of the small grain. There was no appreciable difference in the weight of the straw.

In 1922 fresh experiments were undertaken at the Cappelle Station with oats and barley so as to have them under conditions identical with those of DE CALUWE.

L. V.

[1910-1911]

CROPS AND CULTIVATION

AGRICULTURAL
METEOROLOGY

1012 - **Critical Period of Wheat as regards Rain.** — Azzi, G. (Director of the Department of Agricultural Ecology), in *Nuovi Annali del Ministero per l'Agricoltura*, Year 1, No. 2, pp. 299-307. Rome, Dec. 31, 1921.

In the development of cereals critical periods are encountered during which the plant feels most acutely the unfavourable effects of its environment, such as drought.

In the case of wheat the greatest need of moisture is felt: 1) during germination and the initial growth of the young plants; 2) during growth; 3) during the period of earing. The critical period for the formation of ears was previously determined by the writer by means of the formula of correlation and by making use of statistical, meteorological and phenological data ascertained for the Province of Girgenti. It follows that the period of about twenty days required to form ears is of capital importance; if, during this period the total amount of atmospheric precipitation is less than the minimum compatible with the normal development of the plant, the harvest will be poor, even if rain falls during the remainder of the growth period. Wheat can give good crops even with a total rainfall of less than 300 mm.; but as the minimum is approached the influence of the distribution of the rainfall prevails and becomes decisive during the critical period.

In this connection the writer has investigated experimentally 4 varieties of wheat: *Apulia* (Rieti \times Spelta), *Cervaro*, *Carlotta Strampelli* (Rieti \times Massy) and *Spella*. The experiment was carried out at the Botanical Garden of the University of Rome during the agricultural year 1920-1921. The plants were grown in pots; copiously watered from sowing on December 29 up to April 12, and from the 7th day after forming ears up to maturity; during the interval, on the other hand, the plants were given a variable number of waterings: 0 — 1 — 2 — 5. The best selected varieties, of high specific productivity, *Spella* and *Carlotta*, suffered most from the absence or slightness of the watering, the two other varieties were less exacting.

The harmful effect of insufficiency of water during the critical period is shown by: — the total production of grain expressed in weight — the average weight of the grains — the length of the stalks — the length of ears — the weight of straw — etc. There was also a delay in earing and reaching maturity, more noticeable for the selected varieties, especially *Carlotta Strampelli*. The length of the ears did not diminish correlatively with the length of the stalk; on the contrary, in the variety *Apulia*, in spite of want of moisture they maintained an almost invariable length. This capacity of decreasing the length of stalk while maintaining the length of ear unchanged, may be interpreted as a character of adaptation to drought.

With the varieties *Spella* and *Carlotta*, not even as many as 5 waterings

ade in the conditions of the experiment were sufficient for them to reach the production of the two other varieties.

Production therefore depends on two factors: specific productivity and resistance to the unfavourable conditions of environment. In the varieties studied, these two factors were more pronounced in the *more* *dry* varieties. The variety *Cervaro* especially seems to unite in the best proportions the characters of specific productivity and resistance to drought; it is well suited to a dry climate.

Adaptation to drought may arise: — 1) by advancing or retarding the formation of ears so as to alter the critical period; 2) if the roots are deep; 3) if the structure of the plant is such as to enable it to economise moisture. This last is true resistance to drought, and the real object of these experiments.

L. V.

13 — **Plant Indicators of Soil Types.** — KELLEY, A. P., in *Soil Science*, Vol. XIII, No. 6, pp. 411-423. New Brunswick, N. J., June 1922.

From ancient times, it has been observed that the presence of certain plants shows the condition of the soil on which they are growing; VITRO, PLINY and COLUMELLA noted the correlation between the soil and the flora. The idea was developed during the eighteenth century, and in the nineteenth century two schools of thought arose, one, represented by AGELI, SCHIMPER and others attributed the chief importance to chemical conditions, and the other believed in the physical theory founded by HERMANN. Although many of the relations existing between soil and flora have been discovered, comparatively little work has been done correlating plants with soil types.

The author has undertaken a series of researches with the object of determining whether a general hydrogen-ion concentration may be assigned to each of the soil types of southeastern Pennsylvania, and whether a definite relation exists between these soils and the flora growing upon them. He tested many soil types for acidity by the colorimetric method which is the most practical. Borings were made with an auger to the depth of 10 ft. in some cases. It was found that the carbon dioxide in the soil did not affect the reaction.

The acidity of a soil type is a variable quantity, but an average pH value may be assigned to each type. The values obtained represent surface soil conditions; some borings were made with a soil auger, but not enough data are accumulated to formulate conclusions as to the acidity.

Soil acidity is governed in part by such factors as arrested leaf decay, and physiographical features of slope, degree of slope and relative elevation. Some types of soil seem to have a higher degree of acidity in late summer. Soil acidity influences flora to such an extent that certain plants may be assigned as indicators. The author gives a list of the characteristic species for 7 different types of soil. Thus *Quercus alba* is typical of rich neutral soil; *Quercus stellata* is characteristic of poor soil with a high lignestum content; *Quercus pinus* is the dominant tree of acid soil.

Soil acidity may perhaps induce variation in plant species.

A. de B.

[1012-1013]

1014 - **The Control of Soil Moisture by Means of Auto-Irrigators.** — DE PERALTA, F. (Department of Plant Physiology, College of Agriculture, Los Baños, Philippines), in *The Philippine Agriculturist*, Vol. X, No. 10, pp. 467-477, figs. 3, plates 1, bibliography of 4 works. Los Baños, Laguna, May 1922.

LIVINGSTON and KORETSU consider that a soil is satisfactory for plant growth if it can supply water to the root system as rapidly as required; otherwise growth is checked. With these points in mind, the author has investigated the relation of growth to different moisture contents when these are controlled by means of auto-irrigators or provision made for maintenance at the same level by means of a regular supply of water.

A modified LIVINGSTON auto-irrigator was employed. Three vertical cups (irrigators) connected by glass tubing provide the cultures in pots with moisture. A constant supply of water is afforded by means of a mercury control-tube, the free end of which is placed in a water reservoir. For each pot containing oven dry soil, 3 auto-irrigators were employed with a single reservoir. Three parts of pulverised loam to 1 part of coarse sand were used. The height of the mercury in the tubes varied from 40 — 20 — 10 — 5 cm., and zero. The soil moisture determinations gave respectively: 9.39 — 10.4 — 12.29 — 14.43 — 25.11. In the control pots, the moisture determinations were taken twice daily.

Lactuca sativa was used.

In both sets of experiments, there was an increase in dry weight in conjunction with the increase in soil moisture. A constant supply gave more satisfactory results than the periodic and variable supply. The difference was more marked for the high percentage moisture content than for the low content. For example, continued use of the auto-irrigator, and without the mercury medium, gave 5.66 gm. of dry matter. Curtailed use, namely 25.11 % moisture, gave 3.22 gm. or a gain of 75.8 %. A 40 % mercury medium gave 0.88 gm. and a 9.39 % moisture supply gave 0.8 gm., or an increase of only 6 % dry weight.

Comparative Graphs indicate the vegetative growth obtained. In this case also, the use of the auto-irrigator apparently has a beneficial effect when maintained regularly, and not discontinued, but this influence was more marked for the low moisture content than for the high, the gain in leaf area being 155 % to 16 %.

Atmometer experiments were also made, and the general results were as expected. The comparative data will serve in future experiments

J. V.

1015 - **Factors influencing the Determination of Sulphate in Soil.** — HIRST, C. T., and GREAVES, J. E., in *Soil Science*, Vol. XIII, No. 4, pp. 231-239. New Brunswick, N. J., April 1922.

The methods for the determination of sulphates may be divided into two classes, namely, gravimetric and volumetric. The gravimetric method is not as simple and exact as was formerly supposed. In the presence of salts and acids which influence the result in various ways, such as by the occlusion of salts present in the precipitate, or to a less extent by the solubility of the precipitate, a serious error may be introduced, sometimes

even as much as 5 %. The volumetric method, which consists in titrating the excess of barium chloride used to form the precipitate with potassium chromate, followed by a titration with iodine, also causes considerable errors.

The authors have made a series of experiments in order to ascertain the causes which give rise to the errors in the two methods of soil analysis. Experiments with solutions of chloride of sodium, potassium, aluminium and iron showed that sodium chloride has a slightly depressing effect which is somewhat more marked with potassium chloride; the chlorides of aluminium and iron introduced a positive error with the gravimetric method and a negative error with the volumetric. The effect of nitrates is much more noticeable, the alkaline nitrates causing a positive, and the aluminium and iron a negative error. In the analysis of sulphates in samples of soil, it is obvious that clarifying agents such as alum or lime cannot be used and that the centrifuge or a filtration method must be employed. In the experiments which were carried out the soil was mixed with water in the proportion of 1 : 5, but this ratio could be varied considerably. In the case of chlorides and nitrates ten minutes shaking of the soil and water was sufficient, but at least forty minutes were necessary for sulphates.

The volumetric method with chromate always gave negative errors, small in the case of normal solutions, but much greater if the solutions were concentrated or diluted. This method is however to be preferred on account of its rapidity and simplicity; when a fair degree of accuracy is desired a correction must be made for presence of iron, aluminium and nitrates.

A. de B.

016 - **Presence of Cobalt and Nickel in arable Soil.** — BERTRAND, G. and MOKRAGUATZ, in *Comptes rendus de l'Académie des Sciences*, Vol. CLXXV, No. 2, pp. 112-114. Paris, July 1922.

The existence of cobalt and nickel has up to the present appeared to be very localised and deep lying. The writers have recently been able to determine the presence of these elements in arable soil, in small quantities. A sample of garden earth, from the Pasteur Institute, gave under analysis: — 0.0037 per 1000 of cobalt and 0.0174 per 1000 of nickel.

A. de B.

017 - **Tests of Vesuvian Bacteriology.** — ROSSI, G., and RICCARDO, S. (Istituto di Bacteriologia agraria della R. Scuola Superiore di Agricoltura di Portici), in *Nuovi Annali del Ministero per l'Agricoltura*, Year 1, No. 2, pp. 241-255. Rome, Dec. 31, 1921.

The writers offer a contribution to the study of the micro-biological processes which take place in the formation of soils, by determining in them the successive development of the active microbial flora. The Vesuvian zone is admirably suited for this form of research, as it contains large tracts of soils bacteriologically sterile which gradually become covered with vegetation either spontaneously or under the influence of cultivation. In this region sterility is periodically caused: —

1) by the flow of lava;

2) by the eruption of ashes which almost always accompanies the falling in of the cone; the case of 1906 was striking as it produced layers with a depth of as much as 25 cm.;

3) by the action of sulphuric and hydrochloric acids contained in the air in the form of vapours and smoke or carried down by rain. In cultivated soils the ashes may be buried in the ground and they then have a beneficial effect; otherwise they cause sterility.

The succession of macroscopic and microscopic vegetable species in the sterile Vesuvian zone was previously studied by COMES, but a bacteriological examination was not made.

The writers have studied the various bacteriological processes which took place in the soil. In this preliminary test they indicate the results obtained as regards nitrogen fixers, cultivated in the ordinary way with samples of soil in a soil infusion containing 1 ½ % of mannite. In all soils of the circum-Vesuvian plateau zone they found the *Bacillus amylobacter* (*Clostridium pasteurianum*) present in the four forms described by ROSSI in 1908; they also found *Azotobacter*. They were of various sizes and shapes, granular, hollow, etc. At altitudes of 310 and 878 m. nitrogen fixing agents were completely lacking, both those of the *Clostridium* and those of the *Azotobacter* type. An exception must however be made of the "Colle Umberto" which arose in 1895-1899 and in 1906 was covered with ashes which were subsequently carried away by wind and rain. The young student F. S. SATVE found upon it a few forms of *Clostridium*.

The absence of these bacterian species from some soils throws some light on the difficulty which may be met with in reafforesting Vesuvius. Even if a possible relationship between the rooting of some leguminous plants, such as the robinia and the broom, and the root bacteria is excluded it is not impossible that one of the reasons for the frequent want of success in the rooting of woody plants may be found in the absence of certain bacterian species, assuming that other known factors are admitted. The interest of the problem is evident in any case, the Vesuvian zone presenting conditions peculiarly favourable to its solution.

L. V.

1018 - The Influence of Moisture and soluble Salts on the bacterial Activities of the Soil. — GREAVES, J. E., and CARTER, E. G., in *Soil Science*, No. 4, pp. 251-270. New Brunswick, N. J., April 1922.

The authors had formerly studied the influence of moisture on the bacterial activities of the soil and the object of their new work was to consider the effect of various soluble salts upon the water requirements of the ammonifying and nitrifying organisms. The soil used in their experiments was of a sedimentary type with a high lime content and a water-holding capacity of 45 %, and possessed a very interesting bacterial flora. Samples of 100 gm. were each mixed with 2 gm. of dried blood and different quantities of various salts and were put into sterilised pots which were covered and weighed; water was added in amounts increasing from 10 to 45 %. The samples for ammonification were incubated for a few days at a temperature of 28°-30° C, and then analysed; those for nitrification were incubated

for 21 days; every seven days the water content was made up to the initial percentages. The maximum for ammonification was reached: a) with 30 % moisture in the case of untreated soil (14 mg. ammonia in 100 gm.) and of those to which the following salts had been added: sodium carbonate, potassium carbonate, potassium nitrate, calcium carbonate, calcium sulphate, calcium nitrate, magnesium chloride, magnesium carbonate; b) with 35 % moisture in the case of soils to which had been added: sodium sulphate, sodium nitrate, potassium chloride, potassium sulphate.

The samples to which the sulphate or nitrate of magnesium had been added reached their maximum with 25 % moisture.

The relative toxicity of sodium chloride, sodium carbonate, potassium chloride, potassium carbonate and calcium carbonate diminished on increasing the moisture; for example, the addition of chloride or carbonate of potassium to a sample containing 10 % moisture reduced ammonification by 50 %, whereas with 45 % moisture the first salt lowered the result slightly and the carbonate had the opposite effect. In these instances the toxicity was due entirely to osmotic pressure. In the case of other salts tested in the experiments, especially with those of calcium and magnesium, toxicity increased with the moisture content, which suggests the conclusion that the result was not due to physical changes in the soil, but to the physiological effect on the protoplasm of soil organisms.

The untreated soils and those to which had been added carbonate, sulphate or nitrate of sodium, chloride, carbonate, sulphate or nitrate of potassium, and chloride or carbonate of magnesium, reached the maximum for nitric nitrogen production when the soil contained 20 % moisture, whereas the soils containing potassium carbonate, calcium sulphate, calcium nitrate, calcium carbonate, magnesium nitrate and magnesium sulphate reached the maximum with 25 % moisture. When the water-content reached 35 % nitrification ceased in all the pots except in that treated with sodium chloride, where it continued to some extent before the maximum was reached, with 30 % moisture. The addition of water to soils containing small amounts of potassium chloride, potassium sulphate, magnesium nitrate or magnesium chloride changes the toxic medium to one which is favourable for nitrifying bacteria; for example, chloride of potassium is toxic in soil containing 10 % of water but with 20 % there was double the production of nitrates. Nitrate of sodium was the only salt tested, which, even in the presence of a high percentage of water, reduced the production of nitrates, notwithstanding that the passage from a toxic to a stimulating medium by increased water content was very pronounced in the case of sulphates, especially those of potassium, magnesium and calcium.

A. d. B.

1019 - Influence of Hydrogen-ion on Growth of *Azotobacter*. — GAINES, P. L., and BACHMELOR, H. W. (Department of Bacteriology, Kansas Agricultural Experiment Station), in *Science*, Vol. 56, No. 1437, pp. 49-50. Utica, July 14, 1922.

After isolation of several strains of *Azotobacter* from different soils and grown in dextrose media, the maximum hydrogen-ion concentration permitting growth was found to be pH 5.9-6.0 in every case. This

[1018-1019]

is appreciably lower than that reported (pH 6.6-6.8) for two strains by FRED, but agrees closely with previous work by GAINES. As the hydrogen-ion concentration of the medium decreased, growth increased until pH 6.1-6.4 was reached.

No fixation of nitrogen took place in a concentration greater than pH 5.9, but at pH 6.3-6.5 fixation was as great as in lower concentrations. The growth of the organisms did not affect to any appreciable extent the concentration of the medium.

L. V.

1020 - **The Carbon and Nitrogen Relations of the Nitrite Ferment.** — BONAZZI, A (Laboratory of Soil Biology of the Ohio Agricultural Experiment Station, Wooster Ohio) in *Journal of Bacteriology*, Vol. 6, No. 5, pp. 479-499, bibliography of 15 works Baltimore, Sept. 1921.

WINOGRADSKY has demonstrated that nitrite fermentation organisms are capable of growing in a medium completely void of organic matter in presence of air, which oxidises the ammonium compounds; nitrite fermentation is followed by an increase in carbon content, which indicates that a source of carbon is found and utilised by the organism. GODLEWSKY as well as WINOGRADSKY and OMELIANSKY, found that cultures of nitrite- and nitrate-forming organisms lacking free or combined carbon dioxide could not develop. BEIJERINCK suggests that the carbon is fixed by the basic carbonate in the culture liquid, and not utilised and assimilated by the organisms; but if this were true it is difficult to explain why the ratio of nitrogen nitrified to carbon assimilated should be of constant value. It appears that an intimate connection exists between these two factors; hence the view advanced by LOEW that this is due to a single biochemical process.

After making several experiments, the author has identified the source of carbon fixed by nitrite organisms. It has been demonstrated that organisms from American soils which differ in form and life-cycle from organisms from Europe and Asia, are similar physiologically. Using the OMELIANSKY solution, it was found that when fermentation occurs and changes the sulphate of ammonia to nitrites, the organisms have recourse to the energy derived from this exothermic reaction to regulate chemosynthesis of carbon in other words to remove the free carbon dioxide and encourage carbon assimilation as a result of fermentation. A limited quantity of nitrogen is also used as an organic source; the nitrites are derived from the waste products.

The effect of magnesium carbonate or nitrous acid on ammonium carbonate is responsible for the liberation of free carbon dioxide.

By a special process, free carbon dioxide was removed from the cultures and a potassium or sodium carbonate absorbent employed to lessen the tension of the atmosphere and disperse that in the solution. In such cases, development is hindered. If this depletion of carbon dioxide in the cultures reaches certain limits, the nitrite organisms are incapable of action which proves the absolute necessity for free carbon dioxide. This is obtainable from the carbonate but the organisms are unable to assimilate from the carbonate direct.

[1019-1020]

Nitrite bacteria are therefore essentially autotrophic, dependent on the presence of free carbon dioxide which leads to the formation of nitric acid and its salts. The functions of autotrophic carbon assimilation and nitrogen nutrition are intimately connected, and mutually interdependent.

L. V.

21 - **Effect of Tree Products on the bacterial Activities in Soil: Ammonification and Nitrification.** — GIBBS, W. M. and WERKMAN, C. H., in *Soil Science*, Vol. XIII, No. 4, pp. 303-322. New Brunswick, N. J., April 1922.

The greater part of the soil of northern Idaho consists of a silt loam. This area is covered with vast forests which are gradually being cleared by removing the timber *en masse* and burning the debris and each year there is an increase in the acreage of land available for agriculture. The first crop on this land is fairly good, but each successive crop is diminished for three or four years but after six or seven years better crops are obtained. This result is attributed to harmful substances left in the soil by the timber which disappear in six or seven years. The fairly good yield obtained from the first harvest can be explained by the small amounts of available plant food left in the soil, which are removed by the first crop.

The object of the author's investigations was to ascertain the effects of these harmful substances on soil bacteria.

FERNOW states that in a century the products formed from the leaves of a forest constitute 15 % of the soil ; in order to be well within the limit found in nature the authors used forest material in amounts varying from 1 to 3 %.

The samples were composed of saw-dust, bark and needles from different forest trees ; three types of soil were chosen for the experiment, forest, garden and field. Samples of soil weighing 100 gm. each were put into bottles of 500 cc. capacity, and 1 gm. of dried blood was added to each and the moisture content brought up to 25 %, and an additional 2 gm. of water to each gm. of wood or other tree product. The samples were incubated at a temperature of 28° C for a week, after which they were analysed for ammonia content. The samples for nitrification were prepared in the same manner except that the moisture content was made up to 20 %, and the incubation lasted four weeks ; the moisture lost by evaporation was replaced each week.

The samples for denitrification were prepared in the same way as were those for ammonification, with the exception that sodium nitrate solution was added instead of blood.

All the substances which were tested reduced ammonification. In the forest soil, cedar (*Thuja plicata*) was the most harmful and reduced ammonia accumulation 78.9 %, the sugar maple coming next as regards toxicity. The white pine (*Pinus monticola*), the least toxic of the group, reduced it 13.1 %. The results were very similar in the case of field soil. Cedar, maple and larch were the most toxic. Among the products other than sawdust *Thuja plicata* needles exerted the greatest inhibitory action, followed by those of *Pinus ponderosa*, *Pinus monticola* and *Abies grandis* ; larch needles had little effect.

All the substances tested proved to be inhibitory to nitrate formation from blood and ammonium sulphate. This effect is reduced but is not entirely removed by applications of 1 % of carbonate of lime.

Ash and maple sawdust in 3 % applications almost stopped nitrification. Cedar, maple, larch and Douglas fir sawdust caused the greatest reduction. Apart from sawdusts, applications of 3 % of white fir, yellow pine and cedar needles practically prevented nitrate formation. Notwithstanding the effect of the needles, white fir sawdust was but slightly detrimental. The forest residue which covered the soil also reduced both ammonification and nitrate formation. On the other hand, ferns, which abound on forest land, had little effect.

The denitrification experiments indicate that the reduction of nitrates is not due to the denitrifying group but to inhibition of the nitrifying organisms. With the exception perhaps of maple and ash none of the substances tested would serve as a source of energy for denitrifying organisms.

A. de B.

1022 - **Soil Fatigue.** — D'HUBERT, A., in *Journal d'Agriculture pratique*, Year 86, No. 7 pp. 136-138. Paris, Febr. 18, 1922

The writer defines the fertility of a soil as its capacity to produce vegetable matter, independently of its chemical composition. Decrease of fertility has been attributed to several causes:—

1) The most simple hypothesis is the soil's exhaustion in nutritive matter. Recent research has shown that this is not adequate, for the composition of soil solutions is, if not constant, at least almost invariable.

2) Another explanation of soil fatigue is furnished by RUSSELL and his collaborators who bring in *antagonism between the germs in the soil*, in which the injurious germs get the better of the useful germs. The former class is represented mainly by protozoa, which by phagocytosis would destroy the latter, represented chiefly by *Azotobacter*. The exhaustion of the fertility of the soil would be due to the rapid increase of the protozoa. This is perfectly correct when it is a matter of crops *in vitro*, but, in nature, protozoa and *Azotobacters* play a secondary part relatively to other living agents. Moreover this hypothesis does not explain why a particular crop e. g. lucerne, cannot be grown again on the same ground except after a certain period of repose.

3) *The injurious effect exercised by the organic residues left by the plant in the soil* is another suggested explanation. These residues may be either dead roots, or pellicles coming from the desquamation of the live roots. In this order of ideas, PRIANICHNIKOW and PÉRITOURINE have proved experimentally that the introduction of fragments of roots into a pot of screened soil reduces the yield. The writer has repeated this experiment under conditions permitting a more rigorous comparison. As soil is too complex a medium for it to be possible to study in it each of the factors which regulate vegetation, he preferred to make use of a sterilized nutritive liquid, in which he grew maize, following the method suggested

by MAZÉ. Three series of experiments were made:— one series grown in a liquid which had not yet borne any crop, one series in a liquid which had already borne a crop of maize, one series in a fresh liquid, but into which fragments of roots had been introduced.

The average lengths of stalk and roots showed marked increases from the 1st to the 2nd and from the 2nd to the 3rd series; they were respectively 60 and 40 mm., 135 and 180 mm., 125 and 200 mm. It is therefore possible to conclude that, at least in the case of young plants, the presence of the dead roots of a plant is very favourable to and does not hinder growth.

4) There remains a fourth hypothesis, closely connected with the last, namely that the plant *elaborates waste products injurious to itself*, which check the development of plants of the same species, behaving like toxins. Although this hypothesis is still slightly inconsistent, it alone can explain several facts.

It is supported by WHITNEY, who quotes the following commonly observed fact: beneath the trees on a lawn there is no vegetation, and the grass disappears. This lack of vegetation is not due to shade for it would then be observed only under the north part of the tree, where the shade is more persistent; but this is not the case, the lack of vegetation being uniform under the crown of the tree. This lack of vegetation is also not due to exhaustion of the soil by the roots of the tree, either in nutritive matter or in moisture, for, whatever amount of manure and water is given, the soil does not recover its fertility. This is therefore in all probability due to the excretion, by the leaves, of injurious substances which the rain carries down to the ground below. It must also be remembered that acid soils are infertile; now acidity in itself, is not injurious; in fact cultures in liquid media require an acid reaction; nor can it be stated that acidity is injurious as checking the process of nitrification; in fact the plant assimilates ammoniacal nitrogen as well as nitric nitrogen; it follows that acidity is merely an indication of the presence of injurious substances.

APPLICATIONS. — This hypothesis has led to a practical application for ascertaining the nutritive value of a soil. The method recommended by WHITNEY consists of rapid comparative experiments of growth, made so as to shield the soil against the action of oxygen which would destroy the vegetable toxins, which are highly liable to oxidation. With this object, the soil tests are made in metal pots steeped in melted paraffin; the experiment lasts only 2 or 3 weeks; the weights of the crops are then taken. By adding manures to the soil it can be ascertained which is the more suitable. The soil Bureau of the United States has used this method for more than 10 years; it is not absolute, but, in practice, its results agree with those given by cultures in the field and chemical analyses do not always give such satisfactory results. It is desirable that further research should be made regarding the nature of the supposed toxic substances and the right means of destroying them. Up to the present time the use of carbon disulphide, toluen, calcium sulphide and heat have been tried empirically; but a strict scientific study is required.

L. V.

[1922]

1023 - **Irrigation in Tunisia.** — CHÉROT and CRUZET, in *Bulletin agricole de l'Algérie Tunisie Maroc*, Year XXVIII, No. 6, pp. 159-175. Algiers, June 1922.

In Tunisia, the work of the Government of the Protectorate for urban and rural water-supply and for agriculture and industry is most praiseworthy. At present there are only 135 places, with a total of 5 000 inhabitants, for which it has not been possible to provide a water supply.

The greater part of the expenditure of about 40 million francs which the Government has devoted to this work has been absorbed by the installations for carrying water to Sousse, to Sfax and to Tunis. These necessary canals are 120 km., 166 km. and 207 km. in length respectively.

The various irrigation undertakings of importance, found chiefly in the centre and south of this region have been grouped as follows for the purpose of Government assistance:—

1) Syndicates using natural spring water	7
2) " " flood water	2
3) " " artesian well water	8
4) " " drainage water.	1
Total	18

Other similar associations are being formed.

After this preamble, the writer gives his personal opinions on the principal questions of drainage and irrigation, and suggests that in Tunisia where the greatest difficulties in the utilisation of local resources are to be found, the programme to be carried out should be:—

- 1) Utilisation of permanent water courses;
- 2) " " alluvial " "
- 3) Search for natural springs;
- 4) Establishment of artificial sources;
- 5) Development of underground springs and reserves;
- 6) Drainage of marshy land and drying marshes;
- 7) Storing water from the mountains in reservoirs;
- 8) Scientific utilisation of natural reservoirs.

Permanent water courses are very scarce in Tunisia. There are however, to the south of the region numerous permanent springs which may sometimes attain a flow of 1200 litres per second.

At present all this wealth of water is more or less used by the local population for the irrigation of the neighbouring land and for motive power. On this subject, the writer gives some personal advice for the resolution of new and important problems of drainage.

UTILISATION OF RUNNING WATER. — As in Tunisia the hygrometrical state of the air undergoes considerable variations, sometimes a sudden change in temperature may precipitate an excessive amount of water which often causes in most of the streams actual flooding and consequently inundations of the neighbouring land which in this way are irrigated and fertilised by the mud and detritus carried by the floods.

Up to the present the natives make, at various chosen points on the streams, rudimentary irrigation works which regulate these inundations

to the best advantage. But these plants, owing to their poor construction and the power of the water flow, are easily carried away and destroyed. Consequently the writer emphasizes the necessity for constructing stable and complete plants which, while entailing heavy capital expenditure, would quickly pay their way through the increase in the local agricultural production.

SEARCH FOR NATURAL SPRINGS. — For this the writer advises the careful study of the geological structure of the land according to the method of Abbé PARAMELLE who, after a long practice of 25 years in 40 Departments of France, has seen his theories crowned with good results.

ESTABLISHMENT OF ARTIFICIAL SOURCES. — In many cases the establishment of artificial sources consists in sinking wells in the customary way, or else, when the sub-soil allows of it, and when the impervious layer is not deep, to bore a tube well.

The tube well can be sunk by NORTON'S method which consists in a steel tube driven through the impervious layer to reach the water-bearing zone, this tube being provided at one end with holes which act as a filter and at the other with a small hand pump for raising the water.

Other methods can also be used, for example those in use in Lombardy and the Northern parts of Italy for irrigating the plain of the Po. They consist of wooden cylinders driven into the ground to a depth of two or three metres through the impervious layer.

But such tube wells cannot be sunk unless the impervious layer is not thick and it is easy to reach the water-bearing stratum.

In conclusion the wells, whether sunk in the ordinary way or by the tube well method are always very useful for purposes of cultivation and irrigation and for all other human needs. Consequently the Inspectors of the Engineering Department should have experience of the means of discovering water-bearing zones so as to be able to give advice and information as to how to make use of these natural sources on request and in return for a suitable fee.

ARTIFICIAL SOURCES. — Among these, in addition to the preceding, the most interesting are artesian wells. The Civil Engineering Department has constructed several in Tunisia which have given really remarkable results. Sometimes again the sub-terranean water is so arranged that after a careful study of the geological formation by means of levelling, excavation, etc. it may be made to rise to the surface level. This was done in 1918 by the Department at the Triba centre of colonisation, by excavating through strata of rocky and marble ground an approximately horizontal tunnel 150 m. long which gave access to a spring of which the minimum daily output is 500 cubic metres.

DEVELOPING UNDERGROUND SPRINGS AND RESERVES. — This development can be obtained by slowing down the flow of running water and thus encouraging infiltration through the soil.

This is not advisable unless the impermeable stratum is fairly shallow, since otherwise difficulties which may be insuperable will be encountered. The means which can be used to obtain the development of sub-

terranean water are many including :— earth dams, infiltration wells, etc.

But these experiments should not be made without a previous survey of the ground by opening up the soil and subsoil, levellings, soundings, etc. The writer noted, in the district of Béja, the unforeseen formation of a very large spring which arose in a badly watered property, after the clearing of a plot of ground hitherto neglected because of its want of fertility. Unintentionally the proprietor had helped to enrich the underground reserves of water with irrigation water by increasing with the clearing the coefficient of infiltration in the land.

IMPROVEMENT OF MARSHY LAND AND DRAINAGE OF MARSHES. —

Although Tunisia is poor in water, the special conformation of the land in the Northern district is favourable to the accumulation of stagnant water and consequently of marshes, swamps, etc. The writer therefore emphasised the immediate steps to be taken for the benefit of the country by indicating the more important places where works of improvement should be carried out.

RESERVOIRS WITH DAMS.— The first work of this kind was constructed in Algeria between 1845 and 1849 at the mouth of the river Fig. in the plains. In the Oran district, where there is an annual rainfall of from 400 to 500 mm., there are 5 ; the Algiers district has 2 ; in the Department of Constantine, where several attempts have been made, there are none.

The writer says that after many years these works have shown their rather serious and peculiar drawbacks. Each year it is observed that the capacity of the reservoirs decreases in a marked degree. For example, the reservoir Djidonia, the initial capacity of which was about 2 200 000 cubic m. could not hold more than 200 000 cubic m. in 1912. Having ascertained this fact, the French engineers tried to lessen the mischief by getting rid of the accumulated detritus, and they did so by using the running water itself, that is to say by sacrificing a volume of water 8 to 10 times that of the mud removed.

Hence the chief difficulty which checks schemes of construction barrage and reservoir is the sense of uncertainty that the basin will not fill up so as to eliminate what are called the "aléas géologiques".

To solve this problem several commissions composed of experts have been formed. It has however not yet been possible to check the decrease in the capacity of these reservoirs under the effect of the accumulation of deposits brought down by the running water, which proves a serious disadvantage in Tunisia.

CONDITIONS NECESSARY FOR THE SATISFACTORY USE OF RESERVOIRS WITH DAMS IN TUNISIA. — According to the writer the best conditions will be realised if the actual volume of water from the rainfall does not exceed double the capacity of the reservoir, so that the half of the water which comes from the autumn rainfall can cleanse the reservoir, the other half, coming from the spring rainfall, only being used. For this reason :

1) A good number of probabilities which are derived *a priori* from topographical examination must be disregarded ;

2) A careful study must be made of the behaviour of the rains and the regulation of the streams of the district, which must be supplemented by geological examination, by soundings and other tests so as to ascertain the local stratification. It is only after these preliminaries that a detailed study of the scheme can properly be made.

UTILISATION OF WATER FROM BARRAGE RESERVOIRS — The greater part of this water is used both for agriculture and for town purposes.

In Tunisia the idea of replacing coal by electricity has always been popular. However as the most important consumers of electricity would be the railway and the mining companies, such substitution would be inexpedient, since the electrification of transport is not important in the country on account of the small number of trains.

NATURAL RESERVOIRS. — Up to the present these reservoirs have not been used by private industry, but they might offer certain advantages for the irrigation of cultivated land. Thus with that object the Sebka, El-Kourgiz and Garoa-El-Hamada could furnish several millions of cubic metres of water.

To sum up, little remains to be done in Tunisia as regards urban and rural water supply, but irrigation and similar schemes can make further use of local resources by utilising all the local supply, by improving and supplementing the plants which already exist with the co-operation of the local Government, which should encourage and help all good private initiative.

G. D.

1024. — **Production of Phosphoric Acid by the Method of Electric Condensation and Precipitation.** — SWANN, T., in *Industrial and Engineering Chemistry*, Vol. 14, No. 7, pp. 630-631. Washington, July 1921.

Up to the present phosphoric acid has generally been prepared by the treatment of mineral phosphates or bones with sulphuric acid. The new method by electric precipitation, is actually in use at Anniston (Alabama, U. S.), where three electric ovens are employed, which require a power of 10 000 H. P. and 44 000 volts.

This method consists in fusing in the electric oven (1) a mixture of crude phosphate, coke, sand and iron shavings. The phosphorus which by this means is set free combines partly with the iron and forms iron phosphide containing 25 % of phosphorus and part volatilises with other gases in the oven and is oxydised in the air; the phosphoric acid of 90-95 % concentration is collected in specially designed condensers, after which it is refined by special methods. The particular advantage of this process consists in the production of a highly concentrated acid which is almost free from iron, as all the iron contained in the phosphorite separates out in the form of phosphide. The acid is sent out in barrels or in transport-tanks lined on the inside with a special acid-resistant, wax compound. For pharmaceutical purposes it is necessary to recrystallise the acid, as by this means a purity of 90 % can be obtained for medicinal use or for making oxygenated water.

(1) See *R. May* 1919, No. 571. (Ed.)

This process has already been applied to the manufacture of fertilisers for which purpose a great expansion can be foreseen.

Fertilisers have already been produced containing ammonia, phosphoric acid and potash, with a fertilising power five times that of the ordinary product.

There should be some means of safeguarding the use of such a concentrated fertiliser, but the concentration will effect a great saving on freight, and it will also be possible to reduce the cost of the fertiliser. In order to fix ammonia, it will be an advantage to replace sulphuric acid by phosphoric acid and in this way to produce a fertiliser which will contain two of the three essential fertilising elements.

A. de B.

1025 - **Enriching Extract of Phosphoric Acid by means of successive Decompositions of Phosphorites.** — BOLKO, E. and SOKOLOVA, O., in *Zeitschrift für Angewandte Chemie*, Year 34, No. 88, pp. 548-550. Leipzig, Nov. 4, 1921.

There are two great difficulties in working Russian phosphorites (1), namely their small content of phosphoric acid and the great distance between their beds in the N. E. and the regions of Central Russia where they are required. Also the ordinary processes with sulphuric acid or bisulphate of soda do not dissolve more than 70 % of the acid contained.

The new process of Prof. PRIANICHNIKOV of Moscow, which not only makes it possible to dissolve all the phosphoric acid, but also gives a richer solution of the mineral, is therefore very important. In this method use is made as solvent not only of sulphuric acid, but also of the phosphoric acid previously extracted. To begin with sulphuric acid slightly in excess is allowed to act on the phosphorite, to which water is added in the proportion of 2 to 3 or of 2 to 4. It is mixed vigorously for half an hour and taken to the filter press. The precipitate is washed with water until it is quite free of phosphoric acid and the water used for washing is not concentrated but is used to dilute the sulphuric acid in the subsequent operations.

The following method is however perhaps preferable: — from the precipitate of the first operation two liquids from washings are obtained which are kept separate and used for washing the precipitate of a second operation. The precipitate is washed for a third time with pure water and three liquids from washings are thus obtained which are used to wash the precipitate in a third operation. This is again washed with pure water, and so on, so that each time an extra liquid from washing is obtained. The operation is repeated five times and at the end the first liquid from washing, which at the beginning contained 8 to 9 % of phosphoric acid, contains 28 % of phosphoric acid, without diminishing the quotient of purity. In fact the quantity of phosphoric acid dissolved does not depend on the quantity of acid used but only on its concentration.

A. de B.

(1) See *R. Aug.* 1913, No. 918. (Ed.)

- 1026 - **Experiments on the fertilising Value of "Supra" disintegrated Phosphate, in Belgium (1).** — GRAFTIAU, J., with the collaboration of GIELE, J. and HARDY, P., in *Bulletin de la Société Chimique de Belgique*, Vol. 31, pp. 22-23. Brussels, 1922.

Disintegrated phosphates are already produced in large quantities: they are obtained by calcining, in a rotary kiln, a mixture of calcareous phosphate with substances acting as a flux. The writer has tested "Supra" in pots of varnished wood fibre. Oats were the principal crop, forage cabbages the after crop. The pots were manured identically with 1.5 gm. of nitrogen in the form of nitrate of soda and 28 gm. of potash in the form of sulphate. The pots with phosphoric acid had 0.75 gm. of manure.

The writer describes in detail the course of the experiment from which he draws the following conclusions:

The test shows the high fertilising value of "Supra". The increased yields are much the same as with slag. This manure may be recommended when it is desired to use basic manures. It cannot be mixed either with manures having the power of setting free ammoniacal nitrogen or with superphosphates, exactly like slag. It is important to note that the manure should be kept dry and when spreading the workers should protect their respiratory organs.

P. C.

- 1027 - **Assimilability of various Phosphate Manures.** — VON WRANGEL, M., in *Landwirtschaftliche Jahrbücher*, Vol. LVII, No. 1, pp. 1-77. Berlin, March 1922.

For a long time the effects of various phosphates on crops in different conditions of environment has been studied at the Experimental Station of Hohenheim (Germany). At first experiments were made with various crude phosphates in the form of oolite, Norwegian crystalline fluorapatite, and of phosphates containing carbonic acid, such as carbonatapatite, staffelite and Lahn's phosphorite. The conditions and the process of absorption in two special plants, mustard and maize, were studied by examining the various chemical reactions of the liquids in the soil. Phosphates of lime soluble with difficulty (crude phosphates or pure tricalcic phosphate) were used and quite different effects were obtained in the two plants, especially regarding the ratio of absorption between the molecule of lime and that of phosphoric acid. This molecular ratio is called the "lime-phosphoric acid factor". It at once seemed probable that from this ratio it would be possible to deduce the capacity of plants for using insoluble phosphates, and to find some explanation regarding the manner in which assimilation of phosphoric acid is caused.

The numerous experiments made show this theoretical supposition to be correct, and this factor may possess great importance. By examining the value of this factor in various plants it is found that the phosphates of lime are not well absorbed by cereals, especially by wheat, rye and barley (1.3); slightly better by oats (1.6) and by maize (3). The potato comes next, then leguminous plants such as beans, peas; clover absorbs well (12), turnips, sugar beet, mangolds and hemp absorb very well (23). tobacco and mustard also well (15). In the recent work of PFEIFFER and

(1) See R. May 1919, No. 572. (Ed.)

RIPPEL, "Behaviour of various plants under the action of phosphates soluble with difficulty" (*Journal für Landwirtschaft*, LXIX, p. 165), in which the "lime-phosphoric acid" factor is calculated, the important discovery is given prominence that with a progressively intensive manuring with phosphoric acid the "lime-phosphoric acid" factor decreases regularly.

The reaction of the soil has very great importance for the rate and degree of absorption of phosphoric acid; the acid reaction facilitates and increases its absorption. The absorption of phosphoric acid by a plant which grows in an acid soil is very great: on the other hand the alkaline reaction increases the absorption of lime. Special experiments made with oats and maize by applying to excess alkaline manuring (with silicate of potassium, nitrate of potassium, nitrate of ammonia and gypsum) and acid manuring (with sulphate of ammonia and sulphate of potassium) have plainly proved that the "lime-phosphoric acid" factor undergoes great variations. To ascertain to what extent plants withstand an acid or alkaline manuring, special experiments were made in cement boxes, made waterproof with a layer of paraffin, in which the reaction of the soil could be quantitatively controlled. In the case of maize the results were such that poisoning by alkaline reaction might be inferred whereas mustard consumed the insoluble phosphates even in the case of alkaline nitrogenous manuring. These experiments also prove a remarkable sensitiveness of mustard to chlorine. In fact the chloride of ammonia produces toxic effects on that plant. Further experiments are in progress in order to ascertain the function of chlorine. During growth a bright green coloration of the soil was also noticed, which may perhaps be explained by the presence of micro-organisms previously studied by REICHNOW, WOLLENWEBER, KNOP and LÖW. Growth was afterwards affected by some infection, as happened in the case of some experiments of comparative manuring with coillite and with carbonate of lime. Experiments were then made to determine what amount of lime is required to prevent the absorption of phosphoric acid. Some plants showed evidence of attempts to eliminate from their circulation the excess of lime which prevented that absorption: for example endogenetical production of oxalic acid, as the writer suggested in a previous work and as the researches of STALK confirm. To control the process sand was neutralised by a special treatment invented by the writer for cultures, by depriving them of all the carbonate of lime present. The sand was next manured and for each molecule of tricalcic phosphate 1 — 2 — 5 — 9 — 20 — 75 — 225 — 675 molecules of carbonate of lime were added progressively and respectively for each culture. Oats did well in the absence of carbonate of lime; the yield diminished by one half with one molecule of carbonate, by one third with two molecules; it was almost nil with larger quantities. On the other hand, maize continued to prosper in a satisfactory manner even with 5 — 9 — 20 molecules of carbonate.

Although in a less degree, the action of tricalcic phosphate can be noticed even in the presence of 225 and 675 molecules. The writer asserts that, the conditions of the soil being identical, there will never be an equal

reaction under the influence of tricalcic phosphate for two plants physiologically different. If plants of mustard and maize are grown in neutral soil to which has been added tricalcic phosphate the nutritive functions will be disturbed and the mustard will die for lack of lime and the maize for want of phosphoric acid, as can be proved by analysis of the ash. The writer attributes the greatest importance to the analysis of the ash. The researches of KRÜGER, EMMERLING and the recent experiments prove therefore that some plant species, although not all, utilise tricalcic phosphate in a satisfactory manner, even in the presence of lime.

The susceptibility of lupines with regard to lime, has been known for many years and has formed the subject of many publications, but hitherto with no definite result. On this subject the researches of PFEIFFER, CREYDT, WALTER MEYUS, KAPPEN, MERKENSCHLAGER, SCHULTZ-LUPITZ and other writers are worth noting; the experiments of BÜSGEN, according to the author, are contradictory. The writer thinks that the injuries caused by lime in lupines result from disturbances in the nutritive functions; easily soluble or physiologically alkaline salts of lime, such as the nitrate and carbonate especially, might, by their presence, prevent the absorption of phosphoric acid. This hypothesis, already expressed by the writer in a previous work, was recently confirmed conclusively.

The preceding observations lead to the establishment of a constant law of polarity between lime and phosphoric acid. Thus it has been ascertained that with manurings of phosphates of lime the absorption of phosphoric acid is very limited. The data of EMMERLING vary between 4 and 17 %, according to the nature of the soil. In experimental stations 30 % is not exceeded. The writer made experiments with tertiary phosphates of iron, aluminium and magnesium. Contrary to the general opinion, the results obtained with the first two were good and those with phosphate of magnesium were remarkable. The methods of manuring employed up to the present are therefore too exclusive in the sense that only phosphates of lime have been considered. The recent experiments have shown that, where the plant does not require lime, the other compounds of phosphoric acid should always be preferred. Regarding the specific case of phospho-magnesian manuring, the writer examines the two processes of assimilation which take place in the plant, namely that of absorption at the expense of ionic soil solutions and that of direct total absorption, without basic residue, of particles of phosphate of magnesium.

The writer next examines and controverts the theory of LOEW, according to which the two substances, calcium and magnesium, should be furnished to plants in a certain relative proportion in order that the best results should be obtained. The writer maintains on the contrary that the form of combination of the two elements is much more important than the quantitative proportion; for example, carbonate of magnesium is injurious, while the sulphate is favourable to growth. EHRENBURG'S law on the lime-potash stoichiometrical ratios, according to which the presence of lime prevents absorption of potash, enters this field of research, the numerical results of which do not always seem reliable.

The practical importance of this subject is worth consideration. In the first place it has been proved that the choice of the base in phosphoric compounds is far from being negligible.

The phosphate "Rhénania" and basic slag, the composition of which is still uncertain, have no great importance. More interesting is the problem whether nitrogen or phosphorus should be preferred. In Liebig's time, mineral phosphates were undoubtedly preferred, but it is possible that since then the soils have changed under the action of a continued mineral manuring. At the present time it is incontestable that nitrogen gives better results than phosphoric acid. Furthermore the quite special conditions of Germany at present must be considered: nitrogenous manuring was already in deficit in many lands before the war, because of its high cost: the soils are on the average more sensitive to nitrogen than to phosphoric acid; then from an economical and national standpoint, nitrogen and potash are produced by German industry, while phosphates have to be imported from abroad. In conclusion the use of other compounds of phosphoric acid in replacement of those hitherto used as artificial manures seems to allow a good result by making possible the disposal of reserves of phosphoric acid. The writer next describes the experimental part of his researches, analysing in detail and chronologically the results given by each experiment, considering in a special way the conditions of soil, irrigation and the manuring.

The description of the experiments is supplemented by 23 large tables in which are grouped the numerical data relative to them, and by 2 photographic plates.

A. d. R.

1028 - **The Supply of Nitrogen for Agriculture in Germany.** — *Wirtschaft und Statistik*, Year 11, No. 3, pp. 72-73, 2 figs. Berlin, Feb. 1922.

From 1913 to 1922 the German production of nitrogen has been the following:—

1913/14	110 000 tons	1920/21	242 000 tons
1918/19	115 000 »	1921/22	290 000 »
1919/20	159 000 »		

Half the production consists of sulphate of ammonia and the other half of nitrate and cyanamide of calcium.

TABLE I. — *Quantities (in tons) of fertilising matter consumed in German agriculture from 1913 to 1920.*

Year of manuring	Nitrogen	Phosphoric acid	Potash
1913.	210 000	630 000	557 000
1918.	115 500	231 000	670 000
1919.	159 200	137 800	750 000
1920.	212 000	268 000	578 000

The figures in Table I are represented graphically (in thousands of tons) in the annexed diagram.

For the year 1921-22 the use of 290 000 tons of nitrogen is estimated and it is expected that the whole of this amount can be supplied by national production. Besides artificial fertilisers must also be reckoned food stuffs, the residues of which (farmyard manure) supply the soil with nutritive principles. This is shown in Table II.

TABLE II. — *Differences in the use of various manures in time of peace and in time of war (in tons)*

Products	1913 Excess of imports (+ = excess of exports)	1920 Excess of imports (+ = excess of exports)
Cattle foods	6 282 000	540 000
Crude feeding matter	1 734 000	329 000
Manures :		
Crude phosphates	297 000	116 000
Nitrogenous manures	710 000	(+ 14 000)
Organic manures	99 000	1 000
Potash salts	(+ 1 676 000)	(+ 843 000)

TABLE III. — *Yields per hectare of the principal crops, in qrs.*

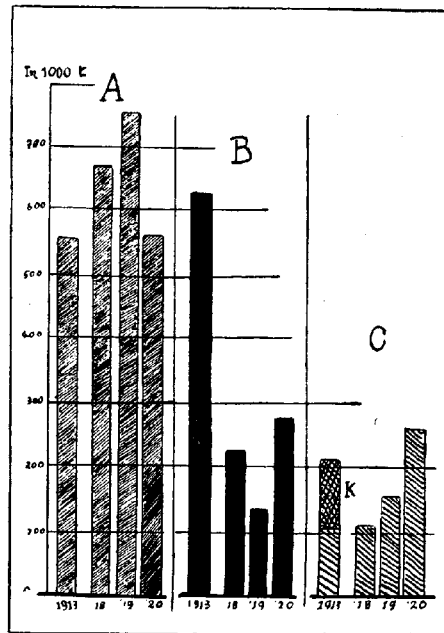
Products	1913	Average of the years 1904-1913	1921
Rye	19.2	17.2	15.9
Wheat	24.1	20.7	20.4
Barley	22.0	19.8	17.1
Oats	22.0	19.0	15.1
Potatoes	157.1	135.1	98.8
Sugar beet	—	287.8	204.9
Hay	49.1	43.0	31.5

TABLE IV. — *Price obtained for nitrogen (in marks per kg.)*

Date	Sulphate of ammonia	Nitrate of Soda	Cyanamide of Calcium
1914	1.35	1.40	1.15
11 January 1916	1.48	—	1.74
13 March 1919	2.60	3.55	2.40
1 October 1919	5.40	6.50	5.40
1 March 1920	12.00	15.00	10.70
1 June 1921	14.50	17.50	12.90
7 October 1921	17.40	24.00	15.50
5 December 1921	25.80	31.20	23.00
Increase in price at the end of 1921 (in proportion to the pre-war price equal to 1)	19.1	22.3	20.0

The cessation of the importation of Chili saltpetre and the great decrease in the importation of cattle foods and crude feeding matter are of special importance. Concentrated foods admittedly supply annually 100 000 tons of nitrogen to German agriculture. The effect of the decrease in manuring is shown by the decreased yield per hectare of the principal crop (see Table III page 1203).

Diagram representing the quantities (in thousands of tons) of fertilising matter consumed in German agriculture from 1913 to 1920.



EXPLANATION:

- A = Potash (K₂O)
- B = Phosphoric acid (P₂O₅)
- C = Nitrogen (N)
- K = Nitrogen contained in Chili saltpetre.

The value of the nitrogen estimated to be used for the year 1921-22, according to the present price, is 7 milliards of marks. Taking the dollar at 180 marks, Chili saltpetre costs double the price of nitrate of soda produced in Germany.

A. d. B.

029 - **Fixation of Atmospheric Nitrogen, and the Fabrication of Nitrogenous Manures in Egypt.** — HUGHES, F., in *Ministry of Agriculture, Egypt. Technical and Scientific Series, Bulletin No. 20*, Cairo, 1922.

After a general survey of the question of the fixation of atmospheric nitrogen, the author deals more especially with the problem of nitrogenous manures in Egypt in relation to soil conditions.

Before the war, Egypt spent some £1,600,000 annually on fertilisers, chiefly nitrate of soda and sulphate of ammonia. So far experiments have not been worked out to any large extent for Egyptian soils, but it may be concluded *a priori* that nitrate of lime is more useful than nitrate of soda. One of the chief drawbacks in Egyptian farming is the presence in the soil of small quantities of sodium salts, usually chloride, sulphate and bicarbonate and rarely carbonate, which is the most troublesome of all. Now as sodium is not one of the essential elements for plant growth the nitrogen from the nitrate of soda may be taken up in the form of nitrate of potash or nitrate of lime and the soda residuum will increase the amount of salts already present in the soil.

Pot experiments have been made with soil from the Nile bank to which various manures were added. Nitrate of lime proved the most effective. Taking the increase brought about by nitrate of soda (average) as 100 the following results are obtained for other fertilisers:— nitrate of lime 104; sulphate of ammonia 92; nitrate of ammonia 98; cyanamide 59. The slowness of the action of organic manures appears to be due to a failure to change the latter to nitrate, but the shortness of the time factor is no doubt of importance in this connection.

As regards the industrial aspect of the question the author states that the Assuan power is available of well over 250,000 HP which would serve to supply some 750,000 tons of nitrate of lime for six months, that is, more than the pre-war demand of the country.

Transport costs are very high in Egypt and hence the preference for concentrated fertilisers such as urea, superphosphates with 40% phosphoric acid content etc.

On the assumption that 100,000 tons of fertilisers were utilized annually, the increased wheat production is estimated at 6 million bushels (17%), which would give a total crop amounting to about 35 millions bushels.

A. d. B.

030 - **Fertilisers for Beans.** — See No. 1050 of this Review.

031 - **Seeds and Plants introduced by the Agricultural Department of the United States.** — *Inventory of Seeds and Plants imported by the Office of Foreign Seed and Plant Introduction during the Periods from: January 1 to March 31, 1917; April 1 to June 30, 1917, July 1 to September 1917; No. 30, 83 pp.; No. 31, 100 pp.; No. 32, 55 pp.* Washington, 1922.

In the first three parts of the inventory of imported plants (which also gives the places where the plants were collected, their description, and the uses to which they could be applied, etc.), FAIRCHILD, Agricultural Explorer in charge, mentions the following:

AGRICULTURAL
BOTANY,
CHEMISTRY
AND
PHYSIOLOGY
OF PLANTS

CEREALS. — A variety of maize (*Zea Mays*) with bitter leaves coming from Rosario (Argentina). Although its yield is somewhat low, and it is liable to attack from grasshoppers, this species of maize can be cultivated advantageously in districts infested with these insects which only eat its leaves when there is absolutely nothing else to be found, as they dislike the bitter taste. This maize could perhaps be employed in crossing experiments undertaken with the view of obtaining forms resistant to disease and to insect attack.

FORAGE PLANTS. — Tussock Grass (*Poa flabellata*) a native of the Falkland Isles, where it grows on the peaty soil near the sea. It makes a good forage and the roots are edible and have a pleasant flavour.

Four forage Gramineae known as "Satintop" viz., *Andropogon cernuoides*, *A. intermedius*, *Chaetochloa barbata* and *Panicum decompositum*, imported from New South Wales are noted for their hardiness and heavy yield.

A collection of 11 species of *Poa* from the Belgian Congo sent by the Leveville Agrostological Garden.

Panicum serratum giving pasturage for sheep at an altitude of 2000 m. near Pretoria (South Africa) is worth trying on the mountain pastures of the Pacific slopes.

Meadow rice grass (*Microlaena stipoides*) from Australia and New Zealand, where it carries large numbers of stock, also merits a trial.

Three selected kinds of Red Clover (*Trifolium pratense*), sent by the Royal Danish Agricultural Society: Tystofte No. 71, early; Tystofte No. 87, late; Hersnap late; the last is the best, and is already grown on a large scale in Denmark.

KITCHEN GARDEN PLANTS. — A wild tomato from Cristobal (Panama Canal region), *Lycopersicon esculentum* resistant to wilt (*Bacillus Solanacearum*).

Manhattan melon (*Citrullus vulgaris*) from Natal.

The fruits can be kept for 6 months; they are much used in South Africa for preserves and are very suitable for this purpose owing to their thick rind which has a high pectin content.

Allium triquetrum, the form bred by TRABUT with very delicately flavoured bulbs.

Pepino (*Solanum muricatum*) from Ecuador, where there are two varieties, one white and the other red, that produce almost seedless fruits making excellent salad.

Gnetum gnemon from the Botanic Garden of Buitenzorg (Java), a shrub growing from the Khasi Mts (British India) to Singapore. It has edible fruits, the leaves can be eaten like spinach and the bark furnishes a stout fibre.

Lorocco vine, an undetermined Apocynae coming from Tegucigalpa, Honduras. It is a perennial climber with deciduous leaves and thrives in temperate climates; the flowers and floral buds are used as a condiment.

A collection of excellent varieties of "pai t'sai" (*Brassica pech-*

nensis), collected in the Provinces of Shantung and Hankow (China). Some kinds can be sown in April-May, August, and September.

ORNAMENTAL PLANTS. — Several strong, beautiful species of *Cotoneaster* suitable for flower gardens. Species of *Cotoneaster* are widely grown in England, but the English forms when introduced into the United States proved too delicate to be generally cultivated.

From Guatemala have been imported: the Monkey-flower tree (*Phyllocarpus septentrionalis*), which bears brilliant red flowers in January — *Lignum vitae* (*Guaiacum guatemalense*), an ever-green shrub with conspicuous purple flowers; this plant was already grown in Florida. — *Salvia Hemsteadiana*, with fine clusters of blue flowers; could be used as a substitute for *S. patens*, a handsome, but delicate plant.

"Pacayito" (*Chamaedorea* sp.), one of the few dwarf palms that can be grown in small pots in dwelling-rooms.

A collection of *Berberis* has been obtained from Columbia, Chili, Tierra del Fuego (Argentina), the Caucasus, Himalaya, Thibet and China. All the varieties are very hardy; some are evergreen, some bear edible fruits while others are seedless. An evergreen type producing large seedless fruits suitable for jelly-making could easily be obtained by crossing the various types.

A collection of different species of *Styrax* purchased by a Paris firm.

Ficus pseudopalma from Corregidor (Philippines), with a crown of leaves which are about 1 m. in length.

Casuarina stricta and *C. Cunninghamiana* natives of Australia. It is hoped that they will prove hardier than *C. equisetifolia* which grows in millions on the road-sides of South Florida.

"Kadoesji" (*Cephalocereus sanguinosus*), a cactus with fine edible fruits.

Butia capitata (1) a hardy palm bearing eatable fruit. A native of Argentina.

PLANTS YIELDING OILS, TANNINS AND GUMS. — "Olivo tafahi" (*Olea europaea*), a native of the Fayum desert (Egypt). It owes its name, which signifies apple-olive, to the unusual size of the fruits; these are 4.5 cm. in length and have a short diameter of 3 cm.

Soft lumbang tree (*Aleurites trisperma*) yields a drying-oil similar to the "tung oil" of China (2)

Tamarix aphylla; the seeds were sent from Algiers by TRABUT. The plant is a native of the Sahara. A mite, *Eriophyes ilaiae* produces on the leaves galls containing 45 % of pyrogallin tannin largely used for tanning purposes by the natives. This plant, which has been tested in the Coachella Valley (United States), has grown to a greater size than any other arborescent species, the girth of shrubs aged 2 ½ years is 90 cm. at 30 cm. from the ground.

(1) See R. July 1921, No. 716. (Ed.)

(2) See R. February 1920, No. 254. (Ed.)

Two African gum acacias from Khartoum (Sudan) *Acacia albidia* and *A. Segal* (1).

VARIOUS PLANTS. — A species of *Amaranthus* (*A. paniculatus*) from Cashmere with farinaceous seeds forming the staple food of the mountain tribes of several parts of India. In these regions, the plant is called "raijgira".

The "Pacaya palm" (*Chamaedorea* sp.) of Guatemala, where it is much grown for its inflorescences which are eaten as salad.

Calycophyllum bravipes, a Venezuelan *Cucurbitacea* with orange-yellow fruits having a sweet pulp and containing (perhaps in the loculi or seeds) a substance more pungent than is found in the capsicum. It is called "parcha de culetra" or the serpent's passionflower. Perhaps it is the "coco de mono" to which is attributed depilatory properties.

Kafir orange (*Strychnos spinosa*), a Loganiaceae from British East Africa imported from Nairobi. The inner part of the bark of this shrub appears to be an antidote to snake-bites. The fruit is edible and resembles an orange: *Strychnos spinosa* grows well in South Florida.

Seeds of *Bambostulda* from Dehra Dun, India. This species is easily cultivated in Panama and at Porto Rico. Its stems make excellent fishingrods.

Cudrania (*Machera*) *tricuspidata* (2) a Moraceae that has become acclimated at Augusta, Georgia (United States) and gives a heavy yield. Silkworms fed on the leaves of this tree produce a silk different from the silk obtained from silkworms fed on mulberry leaves, and better-toned strings for musical instruments can be made from it. As silk is a typical protein, any change in its characters may be of importance for the study of alterations in other proteins.

A new annual Leguminosae (*Aeschynomene* sp.) for green manure. This plant is very well provided with root-nodules and could perhaps be used as a forage plant. It comes from Costa Rica.

Two Rubiaceae sent from Buitenzorg (Java): *Pavetta indica* and *Psychotria bacteriophila*; the latter has also been brought from the Comoro Islands, Madagascar, where it is indigenous: the first named grows throughout India and Malaysia. Both these plants are remarkable for their leaf nodules which resemble the root nodules of leguminosae and, like them, possess the power of fixing atmospheric nitrogen. Their capacity in this respect will be tested in Florida.

VINES. — *Vitis tiliacifolia*, a native of Guatemala, where its fruit is much used for making jellies. It grows well in South Florida, and would make a good stock for American and European vines.

"Callulos" (*Vitis* sp.), from the Mexican valleys; the berries are large and do not fall off when ripe, as in the case of most tropical vines. It is therefore suited to tropical countries and can be cultivated in Florida.

FRUIT TREES, SHRUBS AND BUSHES. — A collection of new varieties

(1) See R. 1921, Nos. 292 and 630. (Ed.)

(2) See R. March 1916, No. 338. (Ed.)

of apple trees raised from seed and sent by the Central Experimental Farm, Ottawa (Canada). Five of them belonging to the Wealthy variety are remarkable for hardiness, resistance to cold and the the flavour of their fruit.

Sixteen different species or hybrids, of the genus *Pyrus* (*P. amygdaliiformis* — *P. betulacfolia* — *P. Bretschneideri* — *P. Calleryana* — *P. phaeocarpa globosa* — *P. heterophylla* — *P. Korshinskyi* — *P. malifolia* — *P. Michauxii* — *P. oblongifolia* — *P. ussuriensis* Maxim — *P. ussuriensis ovoides* Rehder — *P. Pashia* — *P. salicifolia* — *P. serotina* — *P. serrulata*) are worth trying as stocks for grafting. This is a matter of special interest at the present time as an effort is being made to eliminate all European fruit trees as stocks and to substitute for them trees with a more uniform root system.

Several collections of species and varieties of pear tree from the Province of Chihli (China) amongst which are the "pai li" and other cultivated varieties of *Pyrus ussuriensis* with edible fruit; another pear-tree possibly new to science and used as a stock by Chinese fruit-growers; cultivated varieties of *P. Lindleyi* etc. The cultivated varieties of *P. ussuriensis* and *P. Lindleyi* that are resistant to the blight or necrosis of the branches of the apple and pear-tree (*Bacillus amylovorus* [Burril] Trev) may prove of great value in crossing experiments aiming at producing forms that are resistant to this parasite.

The nearly-related genus *Docynia*, of which the species *D. Delavayi* has been imported from West Szechwan and the Yunnan, may also prove useful in the same direction. The lastnamed is also a very vigorous stock for grafting.

Collections of Chinese varieties of peach (*Amygdalus* spp.) from the Province of Kiangsu (China).

"Yacarati-à" or "papaya" (*Carica dodecaphylla*), indigenous in the Provinces of Misiones and Carrantes (Argentina), has been the object of interesting comparative trials with *C. Papaya*, and of crossing experiments. Crosses have already been obtained between *C. caudamarcensis* and *C. Papaya*.

Seeds of *Castanea mollissima* from Nankin (China) useful in crossing for the purpose of obtaining orchard chestnut trees resistant to bark disease (*Endothia parasitica*).

Seeds of *Castanopsis sclerophylla* from Nankin probably useful for the same purpose.

Ziziphus mauritiana, cultivated in India (the best varieties being grown at Kandahar); its fruits are eaten fresh or dried. *Z. mucronata* from Kandahar. These tropical species are to be added to the already rich collection of varieties of *Ziziphus* with large and delicious fruits which have already been introduced from China into the United States where they are grafted on the common varieties and will soon be generally cultivated.

The Kansu *virburnum* (*V. kansuense*), of which the fruit is employed in preserve-making, could perhaps be used for the improvement of the native North American species (*V. americanum*).

From Canada, France, England, Italy and Java, several collections of red, black and yellow currants have been imported. Currants are little grown in the United States, but would probably do well in the Northern States of the Union.

Rubus racemosus from the Nilgin Mts. (British India).

Several collections of avocado (*Persea americana*), made in Guatemala by POPENHOE, and containing the following varieties: "panchoy", early — "benik", midseason — "tumin", exceptionally prolific — "kekci", early with small fruits that ripen slowly — "mayapan", one of the best in the collection, in the opinion of POPENHOE — "cabual" with special hazel-nut flavour — "canel" a very small seeded variety — "pankay" found at the altitude of 1500 m. (i. e. higher than for tropical countries) — "tertoh" bearing fruits that weigh 1800 gm. — a hitherto undescribed kind of *Persea* with fleshy persistent calix — "coyo", or "schukte" (*Persea Schiedeana*) a very rare species, also collected by POPENHOE in Guatemala which is worth introducing into all tropical countries. This plant in the wild state bears fruit which are as good for the table as those produced by *P. americana*; it does not seem to be cultivated in any of the Botanical Gardens of the world. One form has a fine fruit weighing about 2 lb.

Other fruit-bearing species collected by POPENHOE in Guatemala are the Tortoise-shell custard-apple (*Anona testudinea*), with rather tough-skinned fruits containing large seeds and with pulp free of stone-cells — "cereza", or "capuli", the mountain wild cherry-tree (*Prunus salicifolia*), bearing bunches of large fruits (some 18 mm. in diameter) and with a taste similar to that of the ordinary cherry etc.

Mangifera caesia, resembling the mango, worth testing as a grafting stock and in crossing experiments.

Garcinia multiflora of Kiayingchow, near Swatow (China) produces small fruits of delicious flavour resembling that of the mangostan. As this tree can resist a temperature of -3°C it could probably be grown in other than tropical countries, while its similarity to the true mangostan might render it useful in selection work.

A hitherto undescribed species of *Rollinia* coming from the valleys of North Columbia, and bearing edible fruit with orange-coloured skin and pulp, and the biribá (*Rollinia mucosa*), imported from Brazil, form another group of Anonaceae to be added to the collection that is being made for crossing experiments at Miami, Florida.

"Cuatemoya", a hybrid between the "atemoya" (*Anona cherimola* \times *A. squamosa*) which produces delicious fruit, and the "custard apple", or basket anona (*A. reticulata*), have been obtained by WESTER from the Lamao Experiment Station (Philippines).

Guabiroba (*Compomanesia Fenzliana*), a native of Lavras (Minas Gerais, Brazil), a Myrtaceae with delicious flavour similar to that of the guava. In the Plant Introduction Garden of Miami, Florida, it has proved resistant to frosts and would probably bear excellent fruit wherever it was cultivated. *Nephelium bassacense* from Cochinchina comparable to *N. lappaceum* from Java, which produces a delicious fruit.

Litoco (*Calamus* sp.), from Kaingan (Luçon du Nord, Philippines), with bunches of small, slightly acid fruits with a pleasant taste and keeping well.

Tree tomato (*Cyphomandra betacea*), a Solanacea cultivated for its fruit in British East Africa.

FOREST TREES. — A new species of *Picea* (*P. Meyeri*), of large size coming from Shing-hung-sham, in the province of Chihli (China).

Ash from Chinese Turkestan (*Fraxinus potamophila*). This species proved perfectly resistant at Follon (Nevada), and will be a valuable tree for the poor land of the district.

A black, tropical walnut from Porto-Rico (*Juglans portoricensis*) which attains the height of 20-25 m. and produces fruits 3-5 cm. in length. Useful for the proposed hybridisation trials with the object of obtaining quickly-growing timber walnut trees.

Prunus serrulata sachalinensis, which is probably the best wood-producing cherry-tree. It grows to the height of 20 m. Several varieties of a collection of cherry-trees imported from Japan have shown every sign of possible acclimatisation on the Atlantic sea-board of the United States.

"Tzu" (*Catalpa Bungei*), imported from Chekiang (China), a tree of rapid growth. It attains the height of 30 m. and furnishes a very valuable wood for the fancy turnery trade. Much recommended for planting along the ditches and irrigation canals of the semi-arid regions of the United States.

F. D.

1032 — **New and Noteworthy Philippine Plants** (1). — MERRILL, F. D. (Director and Botanist, Bureau of Science, Manila), in *The Philippine Journal of Science*, Vol. 20, No. 4, pp. 367-476. Manila, April 1922.

The 17th of a series of studies published by the author. In the present paper 106 new species are described. Amongst these is included a further description of *Ficus argentea* Blanco, previously known only from BLANCO's imperfect description. *Polychoa* Loureiro is accepted as the proper generic name for the group long known as *Pellonia* Gandichaud. The few Philippine forms formerly placed in *Polytrema* are now transferred to *Hallieracantha*. Three genera are reported for the first time viz. *Pyrrenaria*, *Pleiocarpidia* and *Cowtea*, the latter a recently described genus, previously known by a single species in British North Borneo. A few notes on nomenclature are included, which involve some changes in specific names.

L. V.

1033 — **Nickel and Cobalt in living Organisms**. — VERNADSKY, W. J., in *Comptes rendus de l'Académie des Sciences*, Vol. 175, No. 8, p. 282-285. Paris, Aug. 21, 1922.

Nickel and cobalt belong by geochemical reactions, by the primary and partly secondary minerals and by their behaviour in the organisms, to the *isomorphous series of magnesium*. The elements which form this series give rise to similar chemical phenomena and to compounds which have similar functions in both the inorganic and organic spheres.

(1) See R. July 1922, No. 697. (Ed.)

In biochemistry, five elements of the series, iron, copper, manganese, magnesium and zinc perform similar functions and replace each other. They form an integral part in many complex proteinic pigments which are fundamental in the physiological processes of the animal and vegetable kingdoms:— chlorophyll, hemoglobin, hemocyanin, hemoscycotopin, pinaglobin, etc. Certain physiological phenomena suggest the same chemical facts. It is to be inferred that other elements of the group will also show similar behaviour. These elements are *nickel*, *cobalt*, *cadmium* and possibly also *indium*. The last two have not yet been found in living organisms.

In 1854, J. FORCHHAMMER recognised the presence of nickel and cobalt in marine algae and in the ash of oak; they have also been casually noted, but hitherto there has been no systematic experimentation.

In these conditions the writer in 1918-19 started experiments at Kief with the co-operation of the Academy of Sciences of the Ukraine, but difficulties were caused by the civil war. However the two elements were found in all the organisms on which experiment was made with L. TSCHOUGAJEFF's reagent. In plants, the presence of nickel and cobalt can be determined quantitatively.

The presence of nickel and cobalt was recognised in all the mosses examined from the neighbourhood of Kief. M^{me} M. J. BEZSMERTNY, the writer's assistant, found them in the following plants in the district:— *Plantago media* — *Ficaria ranunculoides* — *Salvia pratensis* — *Taraxacum officinale* — *Avena pubescens* — *Lamium purpureum* — *Capsella Bursa-pastoris* — *Stratiotes aloides* — *Lysimachia thyrsiflora*. Prof. W. SADIKOV, of the Radium Institute at the Russian Academy of Sciences at Petrograd, found cobalt in *Echium vulgare* L. at Salgnirka, Crimea.

The experiments made by M^{me} I. C. STARYNKEWITCH have disclosed the presence of traces of nickel in house mice. L. V.

1034 — Chemical analysis of the Gramineae, *Panicum Maximum*, *P. jumentorum* and *P. barbinode*. — See No. 1033 of this Review.

1035 — Action of soluble Salts of Lead on Plants. — BONNET, F., in *Comptes rendus de l'Académie des Sciences*, Vol. 174, No. 7, pp. 488-491. Paris, Feb. 12, 1922.

With the object of determining the action of soluble salts of lead, numerous tests were made in 1914 on Bordeaux wheat, buckwheat, lupin, lentil, cabbage, etc. The seeds, disinfected in alcohol, were set to germinate in distilled water, and the young plants were placed in solutions of various salts of lead of different degrees of strength. The results were as follows:—

1) The plants subjected to a strong dose of salt (decinormal solutions) absorbed the lead, which was only found again in the bark of the roots.

2) The lead taken out of the solutions was found in its entirety in the ash of the roots of the plant tested, and no traces were found in the ashes of the stalks and leaves.

3) Decinormal solutions of acetate or nitrate of lead are toxic for wheat (killed in 20 days), buckwheat (in 7 days), lupin (in 4 days).

balsamine (in 2 days), lentils (in 1 day) and cabbage. At the strengths used, the salts of potassium, magnesium and calcium did not appear to be antidotes of the lead.

4) Acetate and nitrate of lead gave identical results with wheat and cress. The younger the plant when subjected to the test, the more sensitive is it to the poison.

5) The more concentrated the solution of the salt, the more active is its absorption.

6) The transpiration of plants subjected to the action of lead was markedly decreased in comparison with plants which were grown in pure water.

Further experiments made by the writer in 1921 have fully confirmed these results. They have further shown that the salts of lead cause important modifications in the external morphology of the roots. In pure water roots are long and much branched, thin and unfurnished with absorbent hairs; in solutions of lead they are, on the contrary, short, thick and provided with numerous absorbent hairs. When the growth of the talk is arrested by the lead salts, the growth of the roots is continued, though more slowly, in the same proportions as in normal conditions.

A. d. B.

036 - **The Role of Manganese in Plants.** - Mc HARGUE, J. S., in *The Journal of the American Chemical Society*, Vol. 44, No. 7, pp. 1592-1598, Washington, July 1922.

The presence of manganese in the soil and in the ash of plants was first detected by SCHEELÉ in 1774, but during the nineteenth century few researches were made as to the function of this element. Mention should be made of the work of BERTRAND (1897) and of BRENCHELY (1914) who concluded that manganese is an element essential to the economy of plant life. During the last 20 years, considerable attention has been given to the agricultural problem of manganese and the author knows of as many as 150 investigations on the subject.

While engaged on botanical research work necessitating a test for manganese, the author found that the latter is present in the seeds of many plants, and especially in the seed-coats, the integument of wheat containing approximately 0.02 % of its dry weight of manganese. This induced him to make investigations for the purpose of determining the functions of manganese by growing seedlings in PREIFFER'S nutrient solution after carefully removing all trace of manganese from the compounds used in its preparation. This precaution was necessary as in previous experiments the calcium, magnesium and iron salts used as plant nutrients were found to have contained the small percentage of manganese required by the seedlings. Several lots of wheat were grown, some with and others without manganese. No difference between them was noticed for the first 6 or 8 weeks, but a little later the plants deprived of manganese behaved very differently from the others; their leaves, owing to lack of chlorophyll, became yellowish-green instead of deep green. The differences between the two sets of plants increased as they approached maturity.

those without manganese made a stunted growth and produced no seed. The dry weight of the plants given manganese exceeded by 135 % that of those deprived the element.

Other experiments were made with Alaska peas with very similar results. When analysed, the plants that had received manganese were found to contain 0.179 % of this element, whereas those to which no manganese had been added showed only traces derived probably from the seeds. The importance of manganese to plant development was also proved by growing several different species on sand ; at the present time there are 20 different series of experiments in progress on the subject.

It may be assumed that the small quantity of manganese always present in the seed is sufficient to maintain a normal metabolic process during the first few weeks of growth ; afterwards the manganese is used up in the formation of new tissues and plants that do not receive a further supply of this necessary element become chlorotic. The first change to be noted is a lack in the development of chlorophyll in the later formed tissues and the growing parts ; finally the tips of the branches die back, and the plant almost ceases to develop further.

It appears that leguminous plants are more sensitive to want of manganese than non-legumes ; this suggests that the element is concerned in nitrogen assimilation and the synthesis of proteins. Manganese apparently plays the part of a necessary catalyst in plant metabolism, and together with iron, functions in the synthesis of chlorophyll. A. de B.

1937 - **Influence of Lime on Germination.** — MAQUENNE, L. and CERIGHELLI, R. in *Comptes rendus de l'Académie des Sciences*, Vol. 171, No. 20, pp. 1270-1272. Paris, May 15, 1922.

MAQUENNE in collaboration with DEMOUSSY, has shown that lime is indispensable to germination ; even in very small quantities it triples the length of the roots of peas in 6 days when compared with pure water cultures (1).

The writers have examined the question again and made weight tests independently of tests by length, and extended their experiments to various kinds of seeds, namely : peas, wheat, lentil, cabbage, lettuce, radish, buckwheat and maize. The seeds were washed in sterilised water for 24 hours and the maize seeds were sterilised with a 2 per 1000 solution of sublimate. They were then made to germinate in sand soaked in pure distilled water. After 2 or 3 days they were treated partly with pure distilled water and partly with a 1 millionth solution of sulphate of lime in very weak proportions, similar to those obtained by heating pure water in a burnt clay beaker, which corresponds to about $\frac{1}{100}$ of the lime contained in Paris spring water. The growth took place partly in water or in a calcic solution, partly in sand soaked in water or solution. The temperature was maintained at about 20° C. and the experiments were made in the dark. They were continued as long

(1) See R. 1917, No. 813. (Ed.)

growth of the young plants in the calcic solution lasted, while the growth of the plants in pure water ceased much earlier.

The favourable action of lime on growth was confirmed for all the seeds, both as regards length and weight. The action was more marked in the roots than in the stalks. At the same time there was a total loss of dry matter, without doubt caused by the fact that respiration had become more active in the calcic solution owing to the larger growth of the young plant and was not compensated by photosynthesis, as growth took place in the dark. Maize alone seemed to be an exception, perhaps on account of the abundance of its reserves. The reserves were used in unequal proportions, both absolutely and in proportion to final weight, which is in agreement with the earlier observations of MAZÉ. In the seeds of cabbage, buckwheat and radish, the reserves diminished to a slightly lesser degree than in the control; consequently the writer suspects some error in the experiments. In the others the diminution was more marked. In any case, lime exerts slight influence on the organisation of the reserves, which proves that it does not act of its own accord on respiration.

L. V.

8 - Effect of Röntgen Rayson Cells of *Vicia faba*. — KOMURO, H. (Botanical Institute, College of Agriculture, Imperial University, Tokyo), in *The Botanical Magazine*, Vol. XXXVI, No. 324, pp. 41-45. Tokyo, April 1922.

Seeds of *Vicia Faba* (var. "Hyōgo") were steeped in water for 77 hours (until they had absorbed 57.87 % moisture), and exposed to rays at various intensities (20 H, 40 H and 50 H), and were then sown in sand. After 8 days, the tips of the radicles were fixed in FLEMING'S fluid together with controls (stained sections etc.). The most noticeable changes were seen in the radicles of specially irradiated seeds: enlargement of the cells of parenchymatous tissue sometimes to an unnatural size and of the nucleus; increase in the number of nucleoli; vacuolisation of nucleolus and cytoplasm, increase of chromatic substance (karyolytic and occasional pycnotic additions). Various physiological changes are evident: (mitosis, asymmetrical mitosis, multinucleated cells etc.). There is an obvious effect on the tissues as a whole. The modifications resulting from intense rays, are considered by the author to be partly due to lessened vitality of the cytoplasm (senescence), that is insufficient for normal division. The author leaves the degenerative changes of tumour cells to be of a similar nature.

L. V.

9 - The Effect of Iron and Aluminium Salts upon the Growth of Maize. — ARNDT, C. H., in *American Journal of Botany*, Vol. 9, No. 2, pp. 47-71, 6 figs, 1 Table, bibliography of 46 works. Brooklyn, N. Y., February 1911.

The investigations of HOFFER and CARR on maize diseases have shown that a brown or brownish-purple discoloration of the lower portion of the nodal tissue is often associated with evidences of malnutrition and root-rot. Chemical analysis revealed the presence of considerable quantities of iron and aluminium in the discoloured areas. The injection of iron salts produced a similar change of colour, increased the calcium

talase and oxidase activities, and reduced the H-ion concentration. Aluminium salts produced no discoloration, but their effect upon the physiological activities were similar to those exerted by iron salts. Stalk and root-rot organisms were usually associated with the accumulation of iron and aluminium in the coloured area.

In 1915 BORDNAR reported a correlation between a high aluminium content of the sugar beet and its infection by bacterial organisms. His analyses showed that an accumulation of aluminium preceded infection which indicates that it was related in some way to decreased resistance to infection.

The author gives a historical review of the many experiments that have been made on the subject of the toxic action upon plants of an excess of iron and aluminium (which is generally attributed to the increased acidity of the soil), and on the different effects of the various salts.

The object of the author's investigations was to determine the form and conditions of the toxic action of iron and aluminium salts upon maize and he gives a detailed account of the technique employed. Solution cultures were made in the main part of this experimental work, the results being checked with sand cultures. The solution chosen was the one employed satisfactorily by HARTWELL and PEMBER for studying the effect of aluminium sulphate on barley and rye. It contained: acid calcium phosphate, calcium nitrate, ammonium nitrate, potassium chloride, magnesium sulphate with traces of aluminium, manganese and zinc.

The author also tried a quite different and less complicated solution containing acid potassium phosphate, calcium nitrate and magnesium sulphate. This solution was recommended by the Committee on the Salt Requirements of Representative Agricultural Plants.

The iron phosphate behaved very differently in the two solutions.

In the first, the best results were obtained with 7 mg. per litre; with larger or smaller amounts the maize was less vigorous, whereas higher concentrations proved distinctly toxic.

In the second solution the same salt remained inactive, even when used in quantities 5 times as large as in that mentioned above.

The action of the various iron salts was different; thus optimum growth was obtained in the second solution with 0.0005 N. ferrous sulphate, whereas a 0.001 N., or 0.002 N. concentration of ferric nitrate produced a precipitation and the plants became chlorotic. Ferrous sulphate was almost twice as toxic as ferric sulphate, for the latter was more readily precipitated and its depressing effect was closely related to the H-ion concentration produced by its hydrolysis or precipitation.

Sulphuric, nitric and hydrochloric acids were about equally toxic when added to either solution in low concentration. Sulphuric acid is however the best tolerated, especially by the roots. The aluminium and iron salts of these acids behaved in the same manner, their effect depending upon the acid radical.

An initial H-ion concentration less than pH = 3.7 had little effect upon the rate of growth, for in most cases, the plant tended to shift the reac-

tion towards neutrality. In this it was not however always successful; thus when ferrous sulphate and certain concentrations of the chlorides were added to the cultures, plant growth increased the initial H-ion concentration of the solution. The reaction was most readily shifted towards neutrality when the acidity was due to sulphuric acid which, as has been seen, had the least depressing action upon growth and therefore the change in the reaction was proportional to the size and activity of the plant.

In the first solution, the aluminium salts remained in solution and were directly toxic, in the second, they were readily precipitated and hence exerted an indirect toxic action due to the H-ion concentration produced. The nitrate seemed to be somewhat more toxic than the other aluminium salts and showed a greater tendency to produce chlorosis.

Both iron and aluminium salts collected in the lower portion of the total region, but only the first produced discoloration.

In sand, the toxicity of the acid and salts was much reduced, higher concentrations being needed to produce the same effects.

L. V.

1040 - **Growth of Plants in Relation to Soil Humidity.** — See No. 1014 of this *Review*.

1041 - **Reaction in Fresh Water caused by Aquatic Plants.** — LAPICQUE, L., and KERGOUMARD, Thérèse, in *Comptes rendus de la Société de Biologie*, Vol. LXXXVII, No. 26 pp. 512-515. Paris, July 15, 1922.

The writers have experimented on *Spirogyra* and *Elodea canadensis*; they could not make use of *Polamogeton* and Algae (*Mongeotia*?) taken from the Seine because these plants were too laden with bacteria and animalculae which exerted a disturbing action.

They arranged the plants in open vessels containing Seine water or spring water. These two waters had a concentration of hydrogen ions (pH) respectively equal to 7.3 and 7.6: leaving the former standing in the open air its alkalinity slowly increased until it reached pH = 7.8, evidently due to the escape of carbonic acid gas, produced by microorganisms in the pipes. Under the action of aquatic plants in the proportion of 1 gm. of green matter to 50-100 cubic cm. of water, the alkalinity decreased in the dark until a slight acidity was attained, that is to say that it was less than pH = 7, whereas in the light the alkalinity increased and in the sun could, in a few hours, exceed pH = 9 and even reach pH = 10. This action decreased when the sky was overcast.

It is evident that two opposite actions came into play, namely expiration of carbonic acid, which caused the acidity to increase, and chlorophyll assimilation, which caused it to decrease, a fact previously demonstrated by LOEB, by OSTERHOUT, who made use of it as a method for measuring chlorophyll activity and by WURMSER who made much use of that method. The experiments of these writers, made on marine algae had shown only relatively slight variations, not exceeding a logarithmic unit, while in the course of the above-mentioned experiments the variation reached three units.

L. V.

[1039-1041]

1042 - **Effect of Transpiration on Absorption of Salts by the Plant.** — MUENCHER, W. C., in *American Journal of Botany*, Vol. 9, No. 6, pp. 311-329, bibliography of 22 works, Brooklyn, N. Y., June 1922.

Several contradictory reports have been issued in connection with this subject. Some men of science state that transpiration, and absorption of soil moisture regulate the absorption of mineral substances, whereas others do not admit this explanation.

In order to clear up these differences of opinion, the author carried out a series of methodical experiments. One of these tests was made with a pure line barley grown for 5 weeks in KNOP's solution, in both summer and winter. Transpiration was accelerated or retarded in three ways.

- 1) Variation in atmospheric moisture, by limiting air space and introducing moisture by means of atmometers (LIVINGSTON) and running water, or by absorption with calcium chloride.

- 2) Variation in light intensity, which accelerates or hinders physiological functions and also affects transpiration. The author exposed some plants to direct sunlight and others were grown in the shade.

- 3) Modification in concentration of the moisture necessary for plant nutrition in such a way as to assist or hinder the osmotic changes in the roots. With this end in view, the KNOP solution was diluted to half strength in some cases and in others the concentration was doubled.

In decreasing transpiration by means of the first method, viz. increasing atmospheric moisture when the concentration on the nutrient solution remains constant, no appreciable variation was noticeable in the amount of ash. If on the contrary, the shading method is employed, that is to say reducing the photosynthetic activity to almost half its usual strength, the quantity of ash is similarly decreased. Reduction of transpiration by means of increased concentration of nutrient solution causes decrease in ash.

As regards dry weight, the amount of ash varies very little even if transpiration is accelerated or hindered.

The results indicate that transpiration has no influence whatever on absorption of mineral salts. On the contrary, it is the quantity of organic matter produced by the plant which regulates absorption. As this increases considerably under the influence of sunlight, the quantity of ash also increases. Darkness has the opposite effect. To a limited extent, but always in an indirect manner the concentration of the nutrient solution surrounding the roots and atmospheric moisture surrounding the leaves behaves in a similar way. In every case the relation between the total weight and the quantity of ash remains constant.

The author has made several investigations in order to study the effect of different conditions on the root and shoot. The most important conclusion to be drawn from the results obtained was that, compared with the stem, the root develops more vigorously in the shade than in the sunlight, (determinations with dry matter). This deduction is not applicable in connection with the effect of light or darkness on transpiration. There is no appreciable difference in this respect, between plants grown under moist conditions and those grown under dry conditions.

L. V.

1043 - **Process of Assimilation of Phosphoric Acid in Plants.** — See No. 1027 of this Review.

1044 - **On the Catalysis of Seeds.** — DE VILMORIN I., and CAZAUBON, in *Comptes rendus de l'Académie des Sciences*, Vol. 175, No. 1, pp. 50-51. Paris, July 3, 1922.

SEEDS

A. NÉMÉC and F. DUCHON had shown that the germinative faculty of seeds decreased parallel with the force of catalysis. The writers confirmed that result for some varieties of peas, and showed the relationship very clearly.

In this work they have taken up the enquiry for very slowly germinating seeds of trees, with the object of replacing, if possible, the determination of catalysis by germination tests. They experimented with varieties of pines and larches, but the relationship failed, probably because these seeds have an impermeable envelope.

There have also been cases in which the seeds, though obviously dead, still reacted strongly on oxygenated water producing a considerable liberation of oxygen. After heating for half an hour at 100° C the amount of gas liberated became insignificant.

L. V.

1045 - **Weight and Size of Seeds as Factors influencing Yield.** — See No. 1011 of this Review.

1046 - **Hard Moroccan Wheats.** — NIÈGE, E., in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. VIII, No. 17, pp. 522-527, May 10, 1922 and No. 20, pp. 584-588, May 31, 1922. Paris.

CEREALS
AND
PULSE CROPS

Wheat cultivation covers an area of about 800 000 ha. in Morocco. The varieties grown are all of more or less impure. The different forms can however be isolated and may be grouped in classes corresponding to four essential types Zréa, Trikkia, Asker and Maizza. The Zréa group has generally straight elongated, pyramidal fairly compact ears tapering at the top, with long white or slightly pigmented awns and with solid or semi-solid straw. The grain is large, decidedly hard, non-symmetrical with concave base. In this class, the white Zréas and the red Zréas wheats are well known and much valued.

The Trikkia group is also very common; it is characterised by a short, highly compact, oblong or triangular ear sometimes club shaped and curved, very broad in section; the grain is non-symmetrical, with the base usually flat or even slightly convex and with the apex often crooked. The straw is solid or semi-solid and shorter than that of the Zréas. The wheats are divided into white and red varieties.

The Asker group is especially common in northern Morocco; under this designation are classed the smooth eared varieties, yellow or white, with white awns and solid straw, hard grain, shorter and thicker than the preceding, more rounded and always of a dark colour. The ears are fairly long, semi-open, generally cylindrical and much narrower than the Trikkias and Zréas. This class is grown on poor soils.

The Maizza group includes all the blackeared wheats; it is divided into smooth Maizza and hairy Maizza. It is a complex group directly

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allied to the two principal classes of white wheats, the Zréas and the Trikkias.

A comparative study of these wheats has been made for a year. They were sown on the December 1, 1920 in a poor sandy soil, in lines 20 cm. apart, at a depth of 7 cm. and each grain was 5 cm. from the next. The rainfall for the year was rather above the average. The hard Moroccan wheats have shown themselves to be rather late, somewhat subject to rust but possess good agricultural qualities. The Zréas have given the best results, especially the white smooth kinds. The average weight of the ears exceeds 5 grammes. The Trikkias are placed second with an average weight of ears 4.37 gm.

The Maizzas, inferior to the former, are however better than the Askers.

Chemical analysis indicates a high percentage of nitrogenous matter sometimes exceeding 15 % and very little moisture.

In short, according to this preliminary test, the hard Moroccan wheats are wheats of excellent quality and value.

P. C

1047 - **Is the Transplantation of Maize advantageous?** — MORETTINI, A. (R. Istituto Superiore Agrario Sperimentale, Perugia), in *L'Italia agricola*, Year 50, No. 8, pp. 259-263. Piacenza, Aug. 1922.

SCHREBER in France and ULPANI in Italy have suggested the transplanting of maize so that it may serve as a second crop after wheat. This method is not however employed in any of the countries where maize is cultivated. As no experimental data were available, the writer has tried this method several times at San Donà di Piave and on the estate of Casalina, attached to the Institute of Agricultural Experiments at Perugia and has made the following report:—

1) The growth of maize by transplanting is technically possible, as the plants take root again fairly easily and slight watering at the time of transplanting suffices to ensure that more than 90 % take root again in normal conditions.

2) As compared with plants from direct sowing, those which have been transplanted have greater root development owing to the greater number of internodes covered by the soil, and not less development of the part above ground; they ripen 10 to 15 days earlier and certainly give a higher yield. On the other hand there is the increased cost of labour, which, in ordinary circumstances makes the transplantation of maize generally undesirable, except in special conditions as for example to replace crops that have failed or blanks caused by insects or other agents in ordinary crops, or else as a second crop after wheat.

F. D.

1048 - **Competition in Rice Transplanting in the Province of Novara (Italy) in 1921** (1). — NOVELLI, N., TOGNATO, L., and ROFFIA, A., in *L'Agricoltura pratica*, year XXVI, No. 2, pp. 24-31. Novara, 1922.

With the object of encouraging rice growers to adopt on a large scale the practice of transplanting, the "Comitato provinciale di Propaganda

(1) See R. Nov. 1921, No. 1113. (Ed.)

per le colture alimentari della provincia di Novara" in collaboration with the "R. Stazione Sperimentale di Riscoltura" of Vercelli and with the "Cattedra ambulante di Agricoltura" of the Province, held a prize competition for the agricultural year 1921. The prizes amounted to 22 000 *lire* and the total area of the competing rice fields measured 163.20 ha. The variety grown was in all cases but one (Onsen), the original Chinese rice. The present article was the Report of the examining Committee for the competition. Out of 27 transplanting experiments, 9 were made on a new ricefield, — 13 after rape for seed — 1 after colza for seed — 1 after rye for seed — 2 on fallow land — 1 on a 10 year old rice field. The production of rape and colza was 7.50 qx. to 13 qx. of seed per hectare, and that of the first crop of hay from 22 to 42 and up to 70 qx per ha.

Transplanting was limited to small portions of the rice field; it was easy to make comparisons at any point between the transplanted rice and that grown in the ordinary way; they showed that transplanting itself allowed very high average productions of 60 to 65 and up to 78 qx of paddy per hectare to be obtained.

In all these tests and to a more marked degree than in those of former years, thanks to the increasing improvement in method especially as regards the date of transplanting, the number of plants in each small bunch, the distance between the bunches, etc., the various and important advantages which are the result of the adoption of transplanting have been observed. They may be summed up as follows:—

- 1) a surplus production of from 8 to 10 qx of paddy per ha.;
- 2) a secondary crop of rape, colza, forage, or in any case of good green manure;
- 3) less impoverishment of the soil consequent on shorter submersion;
- 4) better grown stalks, and consequently greater resistance to lodging;
- 5) increased development of the panicles and the grain and greater purity of the seed.
- 6) better distribution and increased employment of manual labour.

1049 — **The Encouragement of the Growth of Lupins in Germany.** — SIMON, Prof. (Dresden), in *Deutsche Landwirtschaftliche Presse*, Year 49, No. 46, pp. 316-317, 2 figs. Berlin, June 10, 1922.

The growth of lupins is being developed in Germany and should be encouraged, as the seeds, when deprived of their bitterness by improved methods give an excellent food, rich in protein. The writer remarks that the plant grows not only on light soils, as is generally believed but also on sandy-loam and close granitic soils; it is only necessary that the soil should not contain too much lime (1). Thanks to its vigorous and well developed root system, the lupin is able to find its food even in poor soils; this observation is specially applicable to phosphorus. Further, like all the Leguminosae, this plant enriches the soil with nitrogen, and is therefore an

(1) See *R. May-June 1922*, No. 531. (Ed.)

advantageous crop. In order to secure nitrogen fixation it is necessary to have recourse to inoculation. Although some species of lupins, including the yellow, have been grown in Germany for a long time, its general diffusion is still limited. For this reason the root-inhabiting bacteria of the lupin are either not common in soils in Germany or entirely absent. It is true that, in many places, similar plants are found such as the little *Ornithopus perpusillus* of sandy uncultivated soils, and certain perennial species of lupins native of North America, grown for ornamental purposes or found in woods; but the bacterial species which are special to them, when inoculated on lupins, only produce a feeble growth of nodules.

The Saxon Experimental Station of Vegetable Physiology at Dresden has made various experiments of inoculation of lupins with root-inhabiting bacteria of various other Leguminous plants. For the yellow lupin (*Lupinus luteus*) only the bacteria of serradella (*Ornithopus sativus*) hasten the growth of the plant in similar degrees to those of the bacteria of the yellow lupin itself; the bacteria of other Leguminous plants, such as beans, vetches, red clover, etc. are inert, and the growth of the plant takes place with difficulty, as with the uninoculated control. It is therefore desirable to make use of bacterial colonies taken from the lupins themselves. The inoculation of the soil with another soil is difficult, costly and uncertain and the inoculation of seeds with pure bacterial cultures is preferable. When the crop is already advanced, it may still be worth while to make a late inoculation.

Inoculation is indispensable in soils on which lupins are grown for the first time, but naturally this does not suffice in itself and for example the plants must have a certain amount of potash and phosphorus at their disposal.

For twenty years the bacterial cultures "Azotogen", supplied by the Dresden Experiment Station, have given excellent results. The growth of lupins has succeeded very well even in very poor, granitic soils cultivated for the first time: the inoculated lupins have made a vigorous growth, while those not inoculated have grown poorly.

Inoculation will prove very important for making large areas cultivable. In this connection the writer states that in Germany there are still 2 million hectares of non-marshy land uncultivated and a still greater area of marshy land.

L. V.

1050 - Action of various Manures on Beans. — VAN HAUTEN, A. (Landw. Versuchsfelde der Universität Göttingen), in *Journal für Landwirtschaft*, Vol. 70, No. 1, pp. 1-7. Berlin, July 1922.

Autumn sowings were made in 8 plots, which had already been manured in previous years and in which the last crop had been barley; they contained average amounts of phosphates and lime. Spring manuring was given with 50 % potassic salt, sulphate of ammonia and basic slag variously compounded.

During growth the lack of potash was already revealed in the plots to which no potassic fertiliser had been applied: the plants did not flourish

and the leaves turned yellow, these differences becoming more marked after flowering. In the plots which were defective in potash, maturation was earlier, but the yield lower; on the other hand manuring with potash caused the yield to show a constant increase though to a less degree when manuring with potash was accompanied by manuring with phosphates. Nitrogenous fertilisers did not have any beneficial effect, which is to be explained by the fact that the beans are able to supply themselves with nitrogen. Phosphatic fertilisers were clearly injurious, evidently because the soil was already over supplied. The yield, in quintals per ha., was as follows: control 12.20 — with potassic fertiliser 16 — with phosphatic 11.40 — with nitrogenous 10 — with potassic and nitrogenous 16 — with potassic and phosphatic 13 — with phosphatic and nitrogenous 8 — with the three fertilisers combined 15.60.

At the same station, FERT had obtained, in 1908, a similar result with the same fertilisers. In estimating the yield in dry matter, the general results are not modified appreciably. The average size of the seeds was very nearly the same, their weights varied from 36.23 to 41.01 gm. per 100 seeds.

The percentage of crude protein was less in the seeds of the potash plots, because, in the latter stages of maturation, the non nitrogenous extracts are preferentially deposited in the seeds. In the potash plots, the maturation of the seeds and consequently the deposit of the non-nitrogenous substances, could be completely effected. Absolutely however, the amount of protein was greater in the potash plots.

Contrary results were given for starch and fats. On the other hand, the percentage of ash was greater in the potash plots, and potash in large quantities was found in the ash.

L. V.

1051 — **Brazilian Forage Plants** (1). — DE SOUZA BRITO, E. C. (Escola Superior de Agricultura e Medicina Veterinária), Apontamentos sobre as nossas principais forragens nativas e cultivadas, *Ministerio da Agricultura, Industria e Commercio, Serviço de Informações*, Rio de Janeiro, 1918. — A. LAVOURA, *Boletim da Sociedade Nacional de Agricultura*, Year XXIV, Nos. 9 and 10, pp. 380-385; Nos. 11 and 12, pp. 425-432. Rio de Janeiro, Sept.-Dec. 1921.

FORAGE CROPS,
MEADOWS
AND PASTURES

Dr. DE SOUZA first considers the importance of the forage question for Brazil. He then quotes all that the Argentine has done to improve its pastures by replacing the hard native grasses by more tender grasses and especially by acclimatising leguminous plants from Europe. He then studies, from a practical standpoint, the principal Brazilian forage plants, indigenous and cultivated, at least such of them as have been determined botanically, analysed and tested in the "postos zootechnicos".

INDIGENOUS FORAGE GRASSES OR THOSE WHICH HAVE BECOME WILD.
— 1) "Capim gordura" or "Catingueiro" (*Melinis minutiflora* (2)). — This is one of the commonest forage plants in almost all the States of

(1) See R. 1915, No. 472; R. 1917, No. 1020; R. 1921, Nos. 386, 1116 and 117.

(2) Syn. *Panicum minutiflorum*. See R. 1915, No. 201; 1917, No. 18; 1921, No. 816. (Ed.)

Brazil. Under a temperate climate, it forms permanent pastures, sometimes very extensive, as in the numerous "fazendas" in the States of Rio de Janeiro, São Paulo, Goyaz, etc. It grows well with the Leguminosae. According to the analyses which have been made at the "Posto Zootecnico Federal", it contains, before flowering, 12.8 % of digestible nutritive substances, with a nutritive ratio of 1 : 20, and after flowering, 21.9 % of digestible matter with a nutritive ratio of 1 : 11.4. The hay contains 49 % of digestible substances. This plant is chiefly suitable for milch cows. There are 3 varieties: — "gordura branco" (white var.) — "gordura roxo de hastes finas y longas" (red var. with long thin stalks) — "gordura roxo de hastes curtas" or "cabello de negro" (red var. with short stalks). The first does best on strong deep soils; the red "capim" prefers stiff soils. This grass is resistant to drought; but not to excessive moisture.

2) "Graminha" or "Capim de burro" (*Cynodon Dactylon*). — Couch-grass is common all over Brazil. The "carrapicho beigo de boi" (*Desmodium ascendens*) is one of the very few leguminous plants that can be associated with it. It resists drought and trampling very well. Before, during and after flowering it contains respectively 21.8 — 26.7 — 31.8 % of digestible nutritive matter, with the nutritive ratios 1 : 10 — 1 : 10.7 — 1 : 13.

3) *Chloris orthonoton*. — Perennial forage plant in high and low meadowland. It is one of the most hardy grasses; it is very tender and delicate and is easily propagated by seed and resists cold and drought. These qualities make it useful, although it has no great nutritive value. Dr. DE ANDRADE found in it 6.8 of nitrogenous matter per 100 of dry matter.

4) "Capim mimoso". — This name is given to several species of grasses, some of which are not yet classified and which grow on natural pastures in areas having a temperate climate. The "capim mimoso" of Matto Grosso and of Goyaz is *Eragrostis pelosa*, very rich in nitrogen (12.66 % of the dry matter) and, consequently, very much recommended for fattening cattle. The same species is called "panasco" in Ceará.

At Parana, this name is given to both *Andropogon tener* var. *Neesii* and *Paspalum marginatum*. The latter does not grow large, but it is well liked by cattle; it stands cold and drought and burning does not destroy it. The grass is common both in the State of Minas Geraes and on the ridges of the Lapa and Urubú.

Andropogon tener var. *Neesii* is one of the good forage plants of Parana; it is tender and stands cold, drought and trampling. It also grows in the States of Minas Geraes and São Paulo. On the fertile and cool soils of the States of São Paulo and Parana grow two other species which bear the name "capim mimoso": — *Panicum capillare* and *P. nitidum*. Their nutritive ratios are respectively 1 : 4.1 and 1 : 6.2.

Another "Capim mimoso"; *Eragrostis lugens* var. *glabrata*, grows on the most fertile soils of Minas and Goyaz up to Montevideo; it is much liked by animals.

5) "Graminha de Campinas" (*Chloris radiata*). — This has neither great growth nor is it hardy, but the grass might be used for making winter pasture. It contains, in the dry matter, 5.4 of nitrogenous matter, and has a nutritive ratio of 1 : 8. Like all species of *Chloris*, it flowers all the year round and produces much seed. Its propagation is easy and as a good forage plant it is worth growing. It is very common in the little frequented pastures of the States of São Paulo, Matto Grosso and Goyaz.

6) "Capim flor" "flecha" or "lanceta" (*Panicum echinolaena*). — Several species of the genera *Letochloa* and *Tristachya* bear the same common names. *Panicum echinolaena* grows on the upland of Uberaba up to Goyaz, Minas, etc., where breeders think highly of it. Before flowering it is tender and then becomes slightly tough. According to an analysis made at the "Instituto Agronomico" of Campinas (*Boletim de Agricultura de São Paulo*, March 1914), the nutritive ratio is 1 : 6.5 ; its composition is therefore good. The grass has a creeping habit and prefers cool soils ; it withstands fires and forms a good constituent of winter pastures.

7) "Capim branco" (*Paspalum brasiliense*). — Very common in Uberaba, Parana, Goyaz, etc. It is slightly hairy, but tender and well liked by cattle.

8) "Capim do campo" (*Panicum cayennense*). — In Para it bears the name of "pennacho". It grows in the States of Parana, São Paulo, Minas, Goyaz, Pernambuco, etc. Cattle only eat the plant if better forage is lacking, because the blades are hairy and prickly. It stands drought and cold well.

9) "Grama commun" (*Paspalum notatum*). — It forms extensive pastures of good forages which grows all the year round. It contains 6.11 % of nitrogenous matter and has a nutritive ratio of 1 : 5.7.

10) "Grama das raças" or "grama comprida" (*Paspalum dilatatum*). — Indigenous and very common in southern Brazil ; cattle like it well ; of high nutritive value and contains 7.94 % of nitrogenous matter, and has a nutritive ratio of 1 : 4.5.

11) "Capim guiné legitimo" (*Panicum maximum*). — Although probably of African origin, is native on dry soils throughout Brazil. It is perennial, of fairly high food value, easily grown, stands drought and is well liked by cattle ; makes good hay and gives several crops a year. Eight varieties are known, all of good quality. The analysis of plants before flowering, made at the "Instituto agronomico" of Campinas, gave as composition of the dry matter :— Nitrogenous substances 9.25 % — fats 1.96 — organic matter 65.67 — non nitrogenous matter 32.26 — cellulose 22.2 — Nutritive ratio 1 : 3.8. It is the forage grass which is preferred in the Antilles, as it will support a large head of cattle. It is specially suited to rather sandy and humiferous soils.

12) "Capim Jaraguá" or "capim provisório" (*Andropogon rufus*) (1). — In Matto Grosso the plant is termed "Sapé gigante" and "Capim vermelho" in Goyaz. It is native in the State of Goyaz, Matto Grosso and

(1) See R. 1917, No. 1154. (Ed.)

Pianhy; perennial; tillers strongly and grows to a large size. Cattle are partial to it. Thrives on cool clay soils and makes good hay provided that it is cut before flowering. It requires annual burning (which can be replaced by heating) and, on fertile soils, a large head of cattle, which slows its growth and delays its hardening.

According to Dr. ATHANASSOF'S analyses, at the "Instituto Agronomico" of Campinas, its digestible nutritive constituents and nutritive ratio have respectively the following values:—*for green forage*:—before flowering:— 15.6 %; 1: 6.8 — during flowering period:— 18.9 %; 1:20.2 — after flowering 20.33 % 1: 25 — *for hay*:— made from grass before the flowering stage — 47.8 %; 1: 10.4 — made from grass after flowering 55.03 %; 1: 15.3 It forms excellent pastures by growing together with "capim gordura" and leguminous plants.

13) "Capim colônião" or "milhã roxo" (*Paspalum virgatum* var. *conspersum*). — It grows in low cool soils; is easily propagated; gives good hay, provided it is cut before flowering — Percentage composition (dry matter):— Nitrogenous matter 6.07 — Fats 1.45 — Non-nitrogenous extracts 35.14 — Cellulose 5.14 — Organic matter 68.07 — Nutritive ratio 1: 6.4. The name "milhã" is also given to the following allied species which have the same habitat and which, like the preceding grass, do not stand frost:— *P. griseum* ("milhã branco") of Parana and São Paulo — *P. intermedium* ("milhã") of São Paulo — *P. malacophyllum* ("milhã roxo") — *P. aureum* ("milhã doirado") of São Paulo Minas, etc. — *P. densum* ("milhã branco" or "milhã da Colonia") — *P. conspersum* ("milhã do brejo") — *P. altissimum* ("milhã colônião") — *P. Cruz-Ardeae* ("milhã de campo") — *P. laeve* "milhã do campo cultivado").

14) "Pasto imperial" (*Paspalum scoparium*). — Indigenous from the Amazon up to Montevideo. There are 4 varieties:— 1) smooth; 2) hairy; 3) with small flowers; 4) with narrow blades. The height exceeds 1 m.; it is propagated by rhizomes and by seed; is resistant to heat. Plants analysed after flowering contained in the dry matter:— 6.64 % nitrogenous matter; 2.10 fat; 37.33 nitrogen free extract; 21.82 cellulose; 67.89 organic matter; nutritive ratio 1: 6.4.

15) "Capim fino de folhas longas" (*Panicum oppresum*). — In Para the plant called "cannarana fina". It grows on the low lands of the State of Rio de Janeiro and of northern Brazil and prefers clay soils and provides a good forage.

16) "Capim de planta" (*P. numidianum*). — Has little nutritive value, but on cool soils gives every year several heavy crops. Nutritive ratio from 1: 10 to 1: 13.2.

17) "Capim de Angola" (*Panicum spectabile*). — Introduced from Africa when colonisation commenced, it is grown in the low lands and is found wild on the banks of the Amazon and Guaporé rivers in the States of Pernambuco, Bahia, Ceará, as well as in the Guianas and the Lesser Antilles. Nutritive ratio 1: 3.2.

18) "Barba de bode" (*Aristida pallens*). — Grows in São Paulo,

Rio Grande, etc. Cattle eat it so long as it is young and tender. Before flowering, its nutritive ratio is 1 : 4.2; after flowering 1 : 10.

Several other species, all of small nutritive value bear the same common name:— *Sporobolus argutus*, nutritive ratio 1 : 10.2 — *Andropogon condensatus*, nutritive ratio 1 : 9.36, of Rio Grande and Minas Geraes — *A. paniculatus*, *Ctenium cirrhosum*, of sterile lands of Minas Geraes and other States — *Eragrostis reptans* of the island of Marajó, characteristic of low clay soils, stands drought, and is useful for horses. There are still other forage plants of the same class:— “Capim limxo” (*Elionurus candidus*) of Rio Grande do Sul, frequent on the sand hills, bitter and, consequently, little liked by cattle — “Capim membeca” (*Andropogon virginicus*), which grows in several States — “Capim branco” or “pasto branco” or “Moroto” (*A. glaucescens*), very common in Minas, Goyaz and São Paulo — “Capim amargoso” (*Elionurus latiflorus*) gives good hay and animals only eat it dry; it can therefore form reserve pastures for the summer (dry plants) or for winter (frozen plants).

19) “Capim bobo” (*Andropogon saccharoides*). — Abundant in Matto Grosso and in the State of São Paulo, on the edges of woods. It does not stand drought, has need of shade and is very nourishing. Nutritive ratio 1 : 4.1.

20) “Capim gigante” (*Tripsacum dactyloides*). — Is considered a good forage in the high lands of Marajó and Pará, but is much more common in Goyaz. The plants in flower reach a height of 3 metres.

21) “Capim burrão”, “grama de Jacobina” (*Chloris bahiensis*). — Excellent forage plant of the interior part of the State of Bahia, and also that of Pernambuco, Pará and some of the Southern States up to Montevideo. It contains in its dry matter:— Nitrogenous matter 10.32 % — Fats 1.18 — nitrogen-free extract 30.27 — Cellulose 19.43 — Organic matter 61.20 — Nutritive ratio 1 : 3.2. Requires cool fertile soils and is worth growing on a large scale on account of its high food value and its facility of adaptation to various zones of the country.

22) “Capim doide”, “capim comprido” (*Andropogon Minarum* Kunth. = *Sorghum Minarum* Hack). — Native and common in several zones of the States of Minas, Espírito Santo and São Paulo. It seems to prefer heavy soils. Perennial; height about 1 metre; has never, so far as is known, caused poisoning.

Another sorghum, *Sorghum halepense*, is grown in the State of São Paulo, which has shown itself very nourishing and stands trampling.

23) *Panicum cordatum*. — Grows only in the low lands of the State of Rio de Janeiro, where it is common on the banks of ditches. It is an excellent forage plant cut for use green and will probably make good hay.

24) “Pampuan” or “papuan” (*Ichnanthus caulicans*). — Breed-ers give this name to several forage plants much esteemed in the interior of Goyaz and of some other States, and which are well suited for fattening cattle. Six varieties of this species have been identified. In the States of Minas, Goyaz São, Paulo and Matto Grosso, the same common name is gi-

ven to a species of *Panicum*; in Pará and Rio Grande do Sul, *Paspalum furcatum* is called "pancuán".

25) "Capim assú" (*Panicum megistum*). — Good forage plant of the island of Marajó; grows on sandy-argillaceous soils, is hardy and reaches a height of 10 metres. It can be mown.

In the interior of Minas, of São Paulo and on the low lands of Parana, the same common name is given to *Erianthus Trinitii*, a good forage plant resistant to cold and drought. In the interior of the State of Bahia, this name is given to *Eragrostis brasiliensis* Nees = *E. bahiensis* Schultes, a perennial plant of about 1 metre in height, well liked by cattle. *Hemiarthra fasciculata*, a fairly good forage plant also bears the same name.

26) "Pé de gallinha". — Several forage grasses some of which have little nutritive value, bear this name: — *Eleusine indica*, common on the heavy soils throughout Brazil (it is called "capim de burro" in the north); it is tender and, under cultivation, gives an abundant production; nutritive ratio 1:3.3 — *Cynodon Dactylon*, more often called "graminha" — *Panicum sanguinale*, very common especially in Matto Grosso, São Paulo and Rio Grande do Sul; gives good hay if it is mown before flowering. — *P. Crus-Galli* — *Poa annua*, common in Rio Grande do Sul and São Paulo.

27) "Capim manexim" or "pé de papagaio" (*Eleusine coracana*). — Before flowering, this plant is very tender; the nutritive ratio is 1:3 and it makes good hay.

28) "Grama de Pernambuco" or "capim de Macahé" (*Paspalum mandiacanum*). — This plant grows abundantly on fertile soils. Before and after flowering the nutritive ratio is respectively, 1:5.6 and 1:3.9. When tender, cattle eat it, but only in the absence of other forage. It is indigenous in the Northern States. Owing to cultivation in the State of São Paulo the composition has been much improved; it contains 8.75% of nitrogenous matter, with a nutritive ratio of 1:4.5. It gives from 7 abundant crops per year.

29) "Capim gordo" (*Paspalum conjugatum*). — In Pará it is called "capim de marreca". It is native on cool soils of Rio Grande Parana, the island of Marajó and the South of Matto Grosso. Nutritive ratio 1:3.3 before flowering; 1:4.9 after flowering. The grass is not resistant to drought.

30) "Capim cocorobó", "capim batatal", "capim cebola" "graminha de Araraquara" (*Chloris distachophylla*). — Grows on sandy shaded soils in several parts of Brazil and Uruguay. Does not stand drought but its composition makes it one of the best forage grasses of Brazil before flowering the nutritive ratio is 1:5.8; during the flowering period 1:4.5; the hay contains 7.09% of protein.

31) "Grama mineira" (*Stenotaphrum glabrum*). — Grows on dry soils; stands drought, but not trampling; perennial; nutritive ratio 1:3.2 said to be of English origin, native in Matto Grosso, Minas, etc.

32) "Grama major Ignacio", "grama de S. Carlos" (*Paspalum laxum* Lam. = *Paspalum plantagineum* N. b. E.). — Very common species at S. Carlos do Pinhal (São Paulo), in Minas, Bahia, Rio de Janeiro.

When cultivated, it gives 6 to 7 crops a year, with a total yield of about 50 tons per ha. The nutritive ratio is narrow, namely 1 : 3.7 before flowering and 1 : 4.3 after.

33) "Capim Araguaya". — This is a still undetermined species of *Paspalum*, very common in the States of Goyaz and Matto Grosso, very much valued as a forage plant. Grows on damp soils and makes good hay.

34) "Cevadilha" (*Bromus unioloides*). — Indigenous in Parana; it is the "resene grass" of North America and the commonest forage plant of the Province of Buenos Aires. It is suitable for cultivation; when trampled by animals it becomes perennial. Nutritive ratio before flowering 1 : 3.6.

35) "Capim palmeira", "capim legue" (*Panicum sulcatum*). — Remarkable for its abundant production and its exceptional richness in nitrogenous matter; nutritive ratio 1 : 2.6 before flowering and 1 : 2.7 after.

The following species, for which the States where they are commonest are indicated, are considered good forage plants :—

- 36) "Capim setaria" (*Setaria brachiata*) :— Ceará.
- 37) "Capim andrekićé" (*Leersia Lexandra*) :— Pará, Goyaz.
- 38) "Peua" (*Andropogon brevifolius*) :— Pará, Goyaz, Amazonia.
- 39) "Capim zabo de rato" (*Panicum villoides*) :— Pará and other states.
- 40) "Sentinella" (*Paspalum parviflorum*) :— Pará, Goyaz, Espírito Santo.
- 41) "Grama do cerrado" (*P. obtusifolium*) :— Paraná.
- 42) "Cannarana rasteira" (*P. repens*) :— Pará, Matto Grosso.
- 43) "Cannarana de folha munda" (*Panicum amplexicaule*) :— Pará etc.
- 44) "Cannarana roxa" (*P. zizanoides*) :— Pará Matto Grosso, Bahia, Minas, Rio Grande.
- 45) "Capim mimoso do Piahy" (*Dactyloctenium aegyptiacum*) :— Pará, Ceará, etc.
- 46) "Forquilla" (*Paspalum papillosum*) :— Pará, etc.
- 47) "Murukiá" (*Eragrostis Vahlíi*) :— from Pará to Southern Brazil.
- 48) *Paspalum platicaulon* :— Rio Grande do Sul.
- 49) "Grama de ponta" (*Triticum repens*) :— Rio Grande do Sul.
- 50) "Coqueirinho" (*Paspalum plicatum*) :— Rio Grande do Sul.
- 51) "Capim arroz" (*Panicum oryzoides*) :— São Paulo and other States.
- 52) "Capim gengibre" (*Paspalum falcatum*) :— São Paulo, etc.
- 53) "Capim felpudo" (*Panicum* sp.).
- 54) "Capim de cheiro" (*Kyllingia odorata*) :— Rio Grande do Sul and States in the north.
- 55) "Capim cevadinha" (*Bromus inermis*) :— Considered to be an exotic; it is native in the State of São Paulo.
- 56) "Capim jaguaré" (*Panicum* sp.) :— Rio Grande do Sul.

57) "Grama lanceta" (*Chloris* sp.): — Campos-Rio.

58) "Capim marambaia" (*Chloris* sp.): — littoral.

59) "Capim camalote" (*Rotiboa compressa* var. *fasciculata*): — on high dry lands of Matto Grosso; excellent forage; durable.

EXOTIC FORAGE GRASSES. — "Capim de Rhodes" (*Chloris Gayana* and "capim favorito" or "capim de Tenerife" (*Tricholaena rosea*) have been introduced into Brazil and grown with success.

INDIGENOUS OR ACCLIMATISED LEGUMINOUS FORAGE PLANTS: —

60) *Zornia diphylla*. — Common throughout Brazil; gives a good hay with 9 % of digestible protein and is well liked by cattle. Thirteen varieties have been identified.

61) *Galactea tenuiflora* var. *villosa*. — Common in Rio Grande do Sul. Perennial. The dry matter contains 19 % of nitrogenous matter.

62) "Carrapicho beigo de boi" or "amor de campo" (*Desmodium ascendens*). — Grows all over South America and in the Lesser Antilles. Associates well with grasses, stands cold and drought and does well on all soils, but best on heavy soils; is easily propagated and is suitable for all kinds of domestic animals. Nutritive ratio 1:5.5.

63) "Barbadinho" or "Carrapicinho" (*Desmodium barbatum*). — Grows throughout South America; eaten by all domestic animals. Nutritive ratio before flowering 1:3.2. More than fifty species of this genus abound in Brazil; among them: — *D. albiflorum* — *D. asperum* — *D. axillare* — *D. cuneatum* — *D. pachyrhizum* — *D. uncinatum* — *D. incanum* — *D. bracteatum* — *D. molle* — *D. leiocarpum* ("marmellada de cavallo") (1) with a nutritive ratio of 1:2.5 before flowering and 1:2.8 for the hay — *D. cajanifolium*, nutritive ratio before flowering 1:2.7 — *D. tortuosum* Welb. = *D. spirale* D. C. ("erva di mendigo", "trevo da Florida"); nutritive ratio 1:2.3 before flowering and 1:2.8 for the hay.

64) "Capim bambú" (*Cassia Langaorfi*): — Common throughout southern Brazil.

65) "Carrapicho" (*Aeschynomene falcata* var. *pleurijuga*): — in almost the whole of South America, in Brazil, etc.

66) "Lentilha do campo" (*A. brasiliensis*): — Pará.

67) "Sensitiva mansa" (*A. sensitiva*); nutritive ratio 1:2.8. *A. americana* Lin. (Glazion), *A. tyacursis* n. sp. Tomb. (Glazion), *A. marginalis* and *A. hystrix* are also good forage plants.

68) *Cassia rotundifolia*. — Throughout Brazil, Central America, the Lesser Antilles.

69) "Feijãozinho" (*Rhynchosia minima*). — In the States of the North and in the districts of the South with a temperate climate. Must not be confounded with "olho de pomba" (*R. phaseoloides*), the leaves of which are supposed to contain a poison, whereas the former is quite harmless.

70) *Vigna vexillata*: — Australia, India, Tropical Africa, Central America and part of Brazil. Good forage plant.

(1) See R. 1920, No. 1097. (Ed.)

71) "Feijão de praia" or "batata sana" (*Vigna luteola*): — Pará, Amazonia, São Paulo. Very much liked by horses.

72) "Wassourinha" (*Stylosanthes viscosa*). — Associates with grasses. Requires cool soils. Cattle are very fond of it. There are 10 species of this genus in Brazil.

73) *Clitoria cajanifolia* Benth. = *Lotus fluminensis* Well. — Common throughout Brazil and in Central America. Bears the name "espe-lina falsa". The same common name is also given to *C. guyanensis*, a good forage plant of the interior of Brazil. There are 15 species of this genus in Brazil.

74) "Oro" (*Phaseolus panduratus*). — Excellent forage plant of the Northern States; the hay contains 18.8 % of digestible protein.

This genus contains 28 species in Brazil, all of them excellent forage plants; the principal of them and their habitats are: — *Ph. Martii*, Ceará — *Ph. longipedunculatus*, Ceará, Pará, Piauí, etc. — *Ph. prostratus*, Rio de Janeiro, São Paulo, Rio Grande do Sul, Minas — *Ph. longifolius*, Rio de Janeiro — *Ph. bruxilensis*, idem — *Ph. lusiocarpus* ("panapanátania" in Pará), Amazonia, Rio Grande do Sul, etc.

75) "Postomeira" or "trifolium hirsuto" (*Eriosema crinitum*): Pará, Minas, Goyaz, São Paulo — *E. longifolium*, *E. stipulare*, *E. strictum*: Goyaz — *E. violaceum*: Rio de Janeiro — have not yet been studied.

76) "Trevo" (*Trifolium polymorphum*) and "trevo branco" (*T. repens*) native in pastures of Rio Grande do Sul.

77) "Manduvira grande" (*Crotalaria paulina*) and "Manduvira pequena" (*C. vitellina*) common throughout Brazil, excellent forage plants.

78) "Feijão de boi" (*C. incana*), much esteemed in Ceará; its dry matter contains 19.5 % of nitrogenous matter, *C. stipularia* and *C. vespertillo*, very nourishing forage plants, grow in Minas and Rio de Janeiro.

79) *Cassia calycioides*. — Common in Goyaz, Piauí, Rio, Pará. The plant, which is not tall is liked by cattle.

80) *Centrosema virginianum*. — Throughout Brazil. Other Brazilian species: — *C. pasenorum* — *C. brasilianum* — *C. rotundifolium* — *C. arenarium* — *C. grandiflorum*. — *C. rubescens* — *C. hastatum*.

FORAGE PLANTS BELONGING TO OTHER FAMILIES. — Compositae. — "Cravórana" or "cravoda roça" (*Ambrosia polystachya*); nutritive ratio 1: 3.4.

Gentianaceae. — "Asperana" (*Menyanthes brasílica*): — Pará, Rio, Goyaz.

Marantaceae. — "Arumarana" (*Thalia geniculata*; *T. pubescens*): — throughout Brazil.

Amarantaceae. — "Ervanço" or "perpetua" (*Telanthra polysonoides*, *T. ramosissima*, *T. brasílica*): — Ceará, Rio, etc. Nutritive ratio 1: 4.

Euphorbiaceae. — "Velame do Campo" (*Croton campestris*) and many species of "mandioca campestre".

Solanaceae. — "Covetinga" or "Capeira branca" (*Solanum auriculatum*), of great nutritive value; it is used in Minas.

Ulmaceae. — "Crindiuva" (*Sponia micrantha*):— throughout Brazil. Good forage plant for dairy cattle.

POISONOUS OR SUSPECTED LEGUMINOUS PLANTS. — *Ph. semierectus* ("faião de rola," feijão de pombinha"), common throughout Brazil and suspected to contain in its leaves a cyanogenetic glucoside; the same is the case with *Teramnus volubilis*, *T. uncinatus*, *Dioclaea latifolia* ("feijão bravo"), etc. On the other hand the following species have harmless leaves and consequently make good forage, but their seeds are known to contain a cyanogenetic glucoside or are suspected of doing so:— *Ph. lanatus* ("fava Belém) — *Ph. amazonicus* — *Ph. caracalla* — *Ph. appendiculatus* — *Ph. obliquifolius* — *Pachyrhizus bulbosus* ("jacatupé") — *Canavalia glaciata* ("fava de quebranto" or "feijão mandatô") — *C. varicolor* var. *obtusifolia* ("feijão fava brava") — *Dioclaea violacea* ("coróonha"), etc.

POISONOUS PLANTS BELONGING TO OTHER FAMILIES (1). — Known under the general name of "ervas" they are numerous. The writer notes:—

Compositae — "Mio-mio" (*Baccharis coridifolia*) (2), more common in Southern Brazil. — "Carrasco do campo" (*B. tarchonanthoides*) — *Lomatozona artemisiaefolia*.

Apocynaceae — "Rosa dos campos" (*Dipladenia illustris* var. *tomentosa*; *D. i.* var. *spigelaeflora*; *D. i.* var. *velutina*; *D. gentianoides* var. *longiloba*):— Minas, São Paulo, Goyaz, etc.

Acanthaceae. — "Herva do gado" (*Chaetothylax lythroides* Lindl. = *Heinzelia lythroides* Nees) — a few species of *Ruellia*.

Dioscoreaceae. — Different species of *Dioscorea*.

Passifloreaceae. — "Maracujá de raposa" or "maracujá de rato" (*Passiflora toxicaria*), fruit poisonous, and several other species.

Rubiaceae. — "Herva de rato" or "tangeraca" (*Psychotria Maravii*) — "douradinha" (*P. xanthophylla*) and a number of others. The genus *Psychotria* alone includes 12 species, almost all poisonous. They are shrubs which grow on the edges of woods in the middle of forage species, sometimes cattle eat them and are poisoned.

Loganiaceae. — "Arapabaea" (*Spigelia anthelmia*); several other species.

Thymelaceae. — "Embira branca" (*Daphnopsis brasiliensis* and *Funifera utilis*).

Umbelliferae. — "Herva capitão" or "acariçoba" (*Hydrocotyle quinquelaba* var. *angulata* and other varieties of the same species — "Cicutu" (*H. leucocephala*).

F. D.

1052 — Varieties of Maize for Silage Purposes. — See No. 1079 of this Review.

(1) See R. 1917, No. 1034: *Rhynchosia phaseoloides* and *R. minima* considered as poisonous for cattle in the State of Rio de Janeiro. (Ed.)

(2) See R. 1919, No. 477. (Ed.)

053 - Composition of the Forage Plants "Guinea grass" (*Panicum maximum* and *P. jumentorum*) and "malojillo" (*P. barbinode*) grown at Porto-Rico. — DOMÍNGUEZ, F. A. L., in *Gobierno de Puerto Rico, Departamento de Agricultura y Trabajo, Estación Experimental Insular, Río Piedras, Circular No. 61*, pp. 35, bibliography of 10 publications. San Juan, 1922.

The "hierba del Pará" or "hierba del Paral" or "malojillo" or "malojilla" (*Panicum barbinode* = *P. muticum*) (1) and the "hierba de Guinea" or Guinea grass (*Panicum maximum* and *P. jumentorum*) are acclimated and widely distributed in Porto-Rico, where they have found very favourable conditions, the former especially on the north coast, where the rainfall is abundant; the latter, more resistant to drought, on the south coast. They are much relished by cattle.

The annexed Table gives the averages of analyses made at the Río Piedras Agricultural Experimental Station. The writer also gives the analysis of the hays: in the general average there was 8.13 % of moisture in the hay of *Panicum barbinode*, and 7.05 % in the hay of *P. maximum*.

The writer compares these data with those obtained for the same forage plants, when cultivated in other countries; he refers to several experiments made by other writers to determine their nutritive value and gives formulae of rations with supplements of concentrates.

Percentage composition and nutritive coefficients
of *Panicum barbinode* and *P. maximum*, grown in Porto-Rico.

	Moisture	Protein	Fats	Crude cellulose	Carbo- hydrates	Ash	Nutri- tive co- efficient
<i>Panicum barbinode</i> :							
Average of all samples (9) . . .	75.97	2.15	0.63	6.47	9.97	2.10	5.3
Samples grown on clay soils. . .	75.23	2.03	0.58	6.12	8.13	2.49	4.9
Samples grown on sandy soils . .	75.51	2.05	0.60	7.27	11.21	2.14	6.5
Green plants	82.02	2.18	0.76	5.13	7.47	1.40	4.2
Ripe plants	72.95	2.13	0.56	7.48	11.37	2.43	5.9
<i>Panicum maximum</i> :							
Average of all samples (4) . . .	73.69	1.68	0.578	8.31	10.91	2.53	7.2
Samples grown on clay soils . . .	74.17	1.77	0.693	7.96	9.90	2.69	6.4
Samples grown on sandy soils . .	73.21	1.60	0.464	8.65	11.92	2.37	8.2
Green plants	77.38	1.81	0.539	6.67	9.61	2.27	5.9
Ripe plants	70.00	1.56	0.618	9.94	12.21	2.78	8.7

F. D.

(1) Some writers give this plant the name of *Panicum molle*, but it belongs to another species. (Author's Note)

1054 - Para Grass (*Panicum barbinode*) and Paspalum (*Paspalum dilatatum*) in the Island of Guam. — BRIGGS, C., in *Guam Agricultural Experiment Station, Bulletin* No. 1, pp. 1-44, tables 15, pl. 6. Washington, Dec. 2, 1921.

Most native forage gramineae in Guam have a low feeding value.

For the last 10 years, the Guam agricultural Experiment Station has made a series of trials with native grasses in the feeding of livestock work, and have proved the necessity of replacing these grasses by imported gramineae of superior quality, such as Para grass (*Panicum barbinode*), and Paspalum (*Paspalum dilatatum*). Both these grasses are adapted to Guam conditions, being very vigorous growers during the wet season, and on the other hand, possessing special drought-resistant qualities (particularly the paspalum) which render them valuable during periods of exceptionally dry weather.

Panicum barbinode was introduced into Guam by the Agricultural Experiment Station in May 1910 from the Hawaii Agricultural Experiment Station, where it had been introduced from the Fiji Island in 1902.

It is a coarse grass with prostrate runners; the stems grow upright when the ground is fairly covered with grass, and the plant reaches a height of 2 to 15 feet. It forms a good pasture grass if carefully laid down. It is readily propagated by seeds, roots, cuttings and by whole stalks. High yields are obtained on lowlands, and these may be increased by the application of farmyard manure or fertilisers. Livestock eat the grass readily.

Both *Panicum barbinode* and *Paspalum dilatatum* should be well established before they are used as pasture. Para grass will support one animal per acre of grass the whole year round and Paspalum can support much heavier grazing.

Paspalum dilatatum was first introduced into Guam in 1909 by the Experiment Station. Seed was obtained from the United States Department of Agriculture. Paspalum is a perennial having a deep fibrous root system, and is a bushy grass when not sown too thickly. It is propagated by seeds or cuttings, but preferably by root cuttings planted 1 foot apart. It is especially suited for pasture and gives a good yield for at least 9 months of the year.

It is adapted to a wide range of soils but grows best on rich and moist lowlands; it will however thrive on comparatively poor and rocky soils. It is estimated to pasture at least 1 to 3 animals per acre all the year round when grown on fairly good soil.

Each of these grasses has an excellent feeding value and a high protein content, 16.30 % average for *Panicum barbinode* and 14.9 % for *Paspalum dilatatum* (air dried).
F. D.

1055 - Forage Sorghums. — VINALL, H. N. and GATTY, R. E. (Office of Forage Crop Investigations, Bureau of Plant Industry), in *United States Department of Agriculture, Bulletin* No. 981, pp. 1-68, figs. 25, bibliography of 20 works. Washington, December 21, 1921.

Sudan grass was introduced into the United States from Africa in 1909, and from the one bag or eight ounces of seed has come practically all the Sudan grass now being grown in the country. The crops sown

increase every year; the value of the 1918 crop was estimated at over 10 million dollars. Sudan grass is to-day grown successfully in Australia, South America, the Philippines, Hawaii, Porto Rico and Cuba.

The plant is now technically known as *Andropogon sorghum sudanensis*, although it was originally introduced from Africa under the name of *Andropogon halepensis*, which belongs to a nearly related species, Johnson Grass (Aleppo sorghum), which differs from it in the possession of rhizomes. The latter form is confined to the Mediterranean basin, while Sudan grass is peculiar to Central and South Africa (see appended map, p. 1236).

A. halepensis is much grown in the Southeastern States of the Union, but it lacks the forage qualities possessed by *A. Sorghum sudanensis*.

The latter is known under several other names, of which one is *Holcus Sorghum sudanensis* (Piper) Hitchc. The author gives a botanical description of the plant and establishes its relationship with closely allied forms, nearly all of which are of African origin. Among them may be mentioned: Tunis Grass (*Andropogon sorghum virgatus* Hack [Piper] — Kamerun Grass (*A. S. effusus* Hackel) — Tabucki Grass (*A. S. verticilliflorus* Stendel) — Chicken Corn (*A. S. Drummondii* [Nees] Hackel, or *Holcus Sorghum Drummondii* [Nees] Hitchc) — a wild sorghum (*A. S. Hewisoni* Piper). The author also mentions the hybrids, especially Austin's "Johnsorgo", obtained from the cross Honey sorgho \times Johnson grass (1).

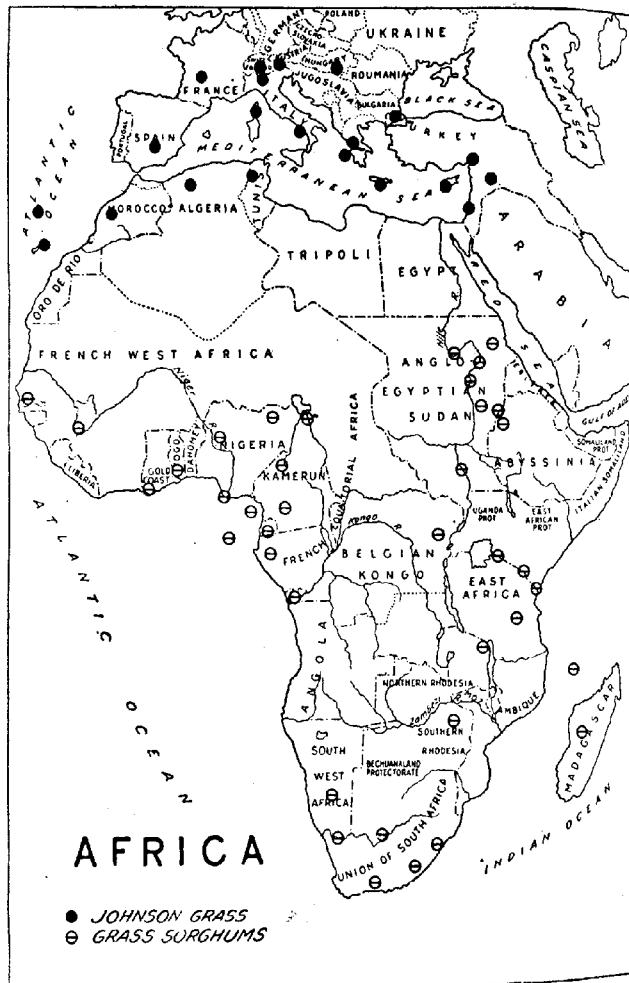
Sudan Grass does not thrive in a cold climate and cannot be grown to advantage at high latitudes, nor within 200 miles of the Northern boundary of the United States. Excessive heat and moisture such as are found on the S. Atlantic coast and the Gulf of Mexico are, however, also not suitable for this plant as it is subject to the attacks of plant and animal parasites. Under other conditions it produces a more or less good crop, because although it has a high water requirement, it is able to withstand protracted periods of drought and recovers quickly when rain comes. Sudan grass is of most value in an emergency for making hay; it forms good summer pasture and is useful as a soiling crop but is not so suitable for silage as maize or ordinary sorghum. Care must be observed when using it as pasture for cattle on account of the prussic acid it contains.

The author gives information regarding the sowing and harvesting of Sudan Grass, its cultivation as a catch-crop, and when mixed with legumes. He also mentions its diseases and enemies together with the best means for their control.

Sudan Grass seed should be planted about $\frac{1}{2}$ inch to $1\frac{1}{2}$ inches deep in moist or heavy soils, and from 1 to 3 inches deep on dry or lighter and. For hay production it is best to drill or broadcast 20 to 25 pounds of seed per acre in the humid regions, and 10 to 15 pounds per acre in the drier portion of the United States.

(1) See R. May-June 1922, No. 535. (Ed.)

*The Natural Distribution of Grass Sorghums in Africa
and of Johnson Grass in Europe, Asia Minor and North Africa.*



For seed production, 3 to 4 pounds of seed per acre are sufficient, drilled in rows 36 to 42 inches apart; the rows should not be too far distant from each other or the roots will develop to an extent that renders subsequent operations difficult. Except in irrigated districts, seed production is now-a-days unprofitable, for the yields are low and the prices uncertain, further there is a great danger of the admixture of Johnson grass seed, and it is practically impossible to separate the seeds of the two grasses by any mechanical means. The author gives the microscopic characters of both kinds of seed. Sudan Grass can easily be crossed with other sorghums. In order to prevent natural crossing, Sudan grass intended for seed production should never be sown on a field which has been under sorghum the previous year, or within 80 rods of other varieties of sorghum. It should not be cut for hay until it has headed, otherwise the yield is much reduced. Sudan Grass dries slowly and must be given plenty of time to cure. Mixed plantings of *A. Sorghum sudanensis* and legumes such as soy beans are profitable only in the more humid regions. The same diseases and insects that attack other sorghums also injure Sudan Grass. *Sphacelothecum sorghi* Link and *Colletotrichum cereale* Manns can be controlled by treating the seed with formaldehyde. Rotation of crops is also very effective.

L. V.

956 - Experimental Growth of "Ghessab" (*Pennisetum spicatum*) in Sicily (1). — SCAVONE, G., in *Giornale degli Allevatori*, Year XVIII, No. 2, pp. 12-13. Catania, 1922.

After noticing the surprising rapidity of growth of "ghessab" in the crops which he had grown at Bengasi, the writer wished to try it near Syracuse, with sowings on irrigation land. It was sown on the 20th May and mown on the 1st July, leaving along the irrigation furrows the best plants for seed production; a second cutting was made at the end of July. During the previous autumn the land had been deeply ploughed and manured, and during the winter it was put under beans. The good results obtained are shewn in the following account made out for a hectare:

EXPENDITURE.

100 kg. of seed at 2 lire	140 lire
10 days ploughing at 40 lire to break up, flatten and furrow the ground for irrigation	240 "
10 days manual labour at 10 lire preparing the ground for irrigation, loosening the soil, sowing, making 6 or 7 waterings, 2 being for the second crop	220 "
10 daily labourers (at 10 lire) and 6 women (at 5 lire) for mowing, harvesting the part left for seed, and collecting the seed	70 "
Rent of irrigable land for 4 months	400 "
Cost of after manuring and sundries	230 "

Total expenditure . . . 1300 lire

(1) See R. July-Aug. 1920, No. 747. (Ed.)

RECEIPTS.

First crop:—350 qx. of grass at <i>lire</i> 7.50	2625 <i>lire</i>
Second crop:—150 qx. of grass at <i>lire</i> 7.50	1125 "
4 qx. of seed at 180 <i>lire</i>	720 "
Pasturage on the 2nd crop and a hundred bundles of grass stalks	130 "
<i>Total receipts</i>	4600 <i>lire</i>
<i>Deduct total expenditure</i>	1300 "
<i>Net profit per hectare</i>	3300 <i>lire</i>

The grass stalks are useful for field coverings and specially for nurseries and hot-beds.

By sowing the seed obtained, in the following year, uniform germination was secured but the growth was less luxuriant. However the half field intended for forage gave two abundant crops; on the other hand the half left for seed flowered well but gave a very small amount of seeds, which could not be collected, as when barely in the milky stage they were attacked by swarms of wasps (*Vespa germanica* and *V. vulgaris*) which ate up the whole of the inside. Birds were also very destructive.

The unsatisfactory results of this second experiment are attributed by the writer to several causes:— not sufficiently careful ploughing — lack of manure — cold and wet season — degeneration of the seed; that used in the first experiment had been brought from Bengasi. F. D.

1057 — **Mangolds in Combination with Maize.** — Succi, A., in *L'Italia agricola*, Year 50, No. 8, pp. 265-268, Piacenza, Aug. 1922.

The writer calls attention to the economic advantage of growing mangolds mixed with maize, a combination which he has tried with success for about twenty years. The mangolds are sown between the lines of maize and at the same time or a little earlier. The two plants spring up and grow together; the maize then develops rapidly and the growth of the mangolds gradually slows down until it stops completely; by degrees as the maize begins to ripen the pressure is eased and the mangolds again begin to grow and after the maize is harvested, develop quite normally.

At this time, the beginning of autumn, the soil is the seat of a powerful chemico-biological activity by which the mangolds are able to profit; they leave therefore to the next crop, which is generally wheat, smaller quantities of fertilising principles and especially of nitrogen; it is therefore necessary to make up the deficiency by abundant manuring of the maize when combined with mangolds or by applying a quick acting fertiliser to the wheat.

That there is no danger of the mangolds dying during the suspension of growth has been ascertained by the writer even in the case of its combination with Caragua giant maize, as well as in southern districts with dry summers and in light mellow volcanic soils.

[1056-1057]

The combination allows for compensation for the damage which in some years drought causes to the maize, for the reduced growth of the maize allows the mangolds to grow larger.

Lastly, the writer gives the appropriate cultural rules:— The soil to be sown should be crumbled; the space between the lines of maize should not exceed or but slightly that of maize grown by itself, e. g. for early Reggio dwarf maize, it should measure 40-50 cm.; no special attention is necessary for the associated crops; weeding and earthing up are done at the same time; the uprooting and transplanting of the mangolds causes no injury to the maize.

Sugar beet is much less suitable for growing with maize; whatever variety is grown the roots can only be used for feeding cattle; it is therefore better to grow mangolds in combination with maize as they give a more abundant crop.

D. F.

1038 - Olive-Growing in the South-West of the United States. — KINMAN, C. F. (Pomologist, Horticultural and Pomological Investigations), in *Farmers' Bulletin* 1249, United States Department of Agriculture, figs. 28, pp. 43, maps 2. Washington, February, 1922.

OIL
PRODUCING
PLANTS

Olive-growing in the United States is confined to California and Arizona. It was introduced by the Franciscan Missions about a century and a half ago, and has increased yearly, so that in 1919 the area under olive-trees in California was 15 160 hectares, and in 1917 there were 246 hectares of oliveyards in Arizona.

The United States imported 149 350 hectolitres of olives and 313 740 hectolitres of olive-oil in 1919. Until 1900 California and Arizona both produced olive-oil, but since that date the whole crop of olives has been preserved in the green state, or when ripe. As there are large tracts in the country suitable for olive-growing, the United States would find it profitable to encourage the development of the industry.

The chief centres of olive cultivation are: the Sacramento Valley, the San Joaquin Valley, the coast of Central California, South California and Arizona.

The author describes the climatic and soil conditions etc. necessary for olive-growing.

The varieties grown are not very numerous. The oldest is the Mission variety, but during the last 30 years of the nineteenth century, more than 80 varieties were introduced from Spain, Italy and France. Since no more oil has been manufactured, these foreign varieties have been superseded by others which bear larger fruits.

After the "Mission" variety, the most important varieties are: "Manzanillo", imported from Spain; this tree produces larger and earlier ripening fruit than the "Mission" and is suitable for regions with early frosts; the tree is vigorous and has a spreading habit of growth — "Ascolano" a native of Italy, bearing some of the largest fruits of oval shape produced by the trees in America — "Sevillana" (Spanish) very widely cultivated, with long oval fruits of excellent quality — "Redding" im-

ported from France, much cultivated, being regarded as the true Picholine, with small fruits yielding much oil — "Nevadillo" a somewhat smaller variety than the Mission; the fruits are regular in shape, but not large enough for preserving.

The author describes the various methods of propagating the olive-tree: from seed, slips and grafts — the distances at which it should be planted — the methods of cultivation — pruning — and irrigation.

The date of gathering the crop varies greatly according to the situation of the olive-yard. In the hot districts of California olives can be picked as early as October, whereas in some parts of the coast, they are not harvested before February.

Olives to preserve well must be sufficiently but not over ripe. Although the colour should be a good guide, it cannot be trusted.

Olives are ready for gathering when their pulp contains 17 % of oil, e. g. for the Mission variety. This percentage is reduced to 15 % in the case of "Manzanillo". Other varieties are picked when relatively green.

In order to prevent injury, the fruit is always hand-picked.

As soon as the olives are collected, they are graded by a sorting machine, the fruit of the different varieties being treated separately.

After sorting the fruits are placed in tanks to undergo the treatment necessary for their preservation.

The bitterness of the olives is removed by a bath of potash solution; afterwards they are carefully aerated to give them a dark colour, washed in cold water and left for some days to soak in salt water, after which they are removed from the tanks, placed in bottles of salt water and put in a water-bath or autoclave.

The author describes the diseases and parasites which attack the olive-tree in the United States.

Among the insects is *Saissetia oleae* Bern (black scale), while of the bacteria, *B. savastanoi* (knot), is the most important. Die-back or exanthema, and Dry-rot are two of the most serious diseases encountered in the olive-yards.

P. C.

SUGAR CROPS

1059 — **Comparative values of Various Nitrogenous Manures for Sugar Cane Growing in Java.** — KUYPER, J., in *Archief voor de Suikerindustrie in Nederlandsch Indië*, 1922. Mededeelingen, No. 3, pp. 145-154 + 6 diagr. Soerabaja, 1922.

For several years field experiments have been made, under the direction of the Pasoeroean experimental Station for sugar cane cultivation, for the values of several nitrogenous manures. Sulphate of ammonia, the manure in general use, the average dose being 425 kg. per hectare, serves as a basis of comparison.

During the last 10 years 162 comparative tests have been made between sulphate of ammonia and nitrate of soda and it has been possible to shew that for sugar cane these two manures have the same value; sulphate of ammonia however is to be preferred as not being hygroscopic.

Cyanamide of calcium is not equal to sulphate of ammonia; in about

[1058-1059]

a hundred tests with cyanamide, the sulphate gave an equal result 24 times and 53 times a better result.

A mixture of nitrate and sulphate of ammonia supplied by the "Badische Anilin und Soda Fabriken" proved too hygroscopic, owing to the conditions of the tropical rainy season. Urea, supplied also by the above mentioned firm, gave the same results as sulphate of ammonia with which it was compared in 12 field experiments; it is therefore considered that urea will form a good substitute for sulphate of ammonia. A more detailed examination was made with ground nut cake. This manure showed itself inferior to sulphate of ammonia but it did better in light soils. It is more efficient when combined with sulphate of ammonia. In all the experiments the amount of nitrogen furnished by the different manures was equivalent.

J. K.

1060 — **Use of the Refractometer in the individual Examination of Sugar Beets.** — MUNERATI, O. and MEZZADROLI, G., in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. I.V, No. 4-6, pp. 163-173. Modena, 1922.

Since 1913, the writer have used at the "Stazione Sperimentale di Bieticoltura" at Rovigo the sugar refractometer to supplement the examination with the polarimeter for the testing of beets for selection. Their long experience thus acquired enables them to report as follows:— the refractometer (sugar type) is very useful for the individual analysis of beets, but it cannot take the place of the polarimeter, except in the case where an approximate idea of the percentage of sugar in the beet is sufficient; the data which the polarimeter and the refractometer give supplement and control one another. The method of examination with the refractometer can replace by reason of its greater accuracy and easier use the method of immersion in a solution of salt or sugar of known density, for classification according to the specific gravity of the roots. The second polarimetrical examination (system of double analysis), which is ordinarily made in selection laboratories to control a preliminary analysis of individuals which have shown a high sugar content, may be replaced by an examination with the refractometer. This method is equally accurate and avoids the risks of spoiling caused by double immersion.

The extra staff and cost entailed by reading the refractometer does not exceed 15-20 % of that which is required for ordinary polarimetrical analyses. The use of the refractometer may be of great value in cases in which it is only necessary to ascertain the density (dry matter) of the juice, or to fix approximately the value of a beet, without making an examination with the polarimeter.

F. D.

1061 — **Chests of Red Cedar (*Juniperus virginiana*) for Protecting Clothing against Damage by Moths (*Tineola biselli* Humm).** — BACK, E. A. (Entomologist in Charge of Stored Product Insect Investigations, Bureau of Entomology) and KABAK, FR. (Chemical Biologist, Drug, Poisonous and Oil Plant Investigations Bureau of Plant Industry), in *U. S. Department of Agriculture, Bulletin* No. 1051, pp. 1-14, bibliography of 18 works. Washington, April 13, 1922.

Red cedar (*Juniperus virginiana*) commonly known as Tennessee or Virginia red cedar, is one of the most widely distributed trees in the

AROMATIC
PLANTS ETC.

[1859-1061]

United States; it is found as far west as the Rocky Mountains, and in Tennessee, Virginia and North Carolina it occurs in large areas of nearly pure forest. It sometimes reaches a height of 90 ft., but usually averages 40 to 50 ft. or less. In general, the red cedar is a straight tree pyramidal in shape. The wood is light, close-grained, compact and durable. The heartwood is red and strongly aromatic (1) while the sapwood is white and odourless.

For centuries chests made of red cedar have enjoyed the reputation of protecting clothing stored in them from the ravages of clothes moths. The authors undertook a comprehensive study of the effect of such chests upon the adults, eggs and larvae of the southern or webbing clothes moth, *Tineola bisellielli* Hummel to see how far these chests were really an adequate protection.

The experiments had a positive result. Chests made of heartwood of red cedar are effective in protecting fabrics from the ravages of the clothes moth if they are beaten, brushed and exposed to the sun before being put away. The authors experimented with 9 chests from the time of manufacture until the chests were 9 years old and are of opinion that they will retain their protective powers indefinitely, if well-cared for. Special precautions must be taken to prevent the chests losing their characteristic odour which is the active factor; they shut tightly and must be left open as little as possible.

Adult moths can live from a fortnight to a month in the chest and lay their eggs, but as they do not eat and the young larvae promptly succumb, no harm is caused by their presence. On the other hand, larvae 3 to 4 months old continue their development. These larger larvae are capable of doing a good deal of damage, although their powers appear to be somewhat diminished by the effect of the chests. The larger the larvae when they enter the chest, the more resistant are they to the aromatic odour, until they reach an age or size, not easily defined, when they acquire the faculty of feeding and developing normally within the chests.

Larvae hatching from eggs within the chests die in most instances within 2 or 3 days, and practically all succumb within a fortnight. If hatched outside and introduced into the chests in clothing, they soon show a tendency to cease feeding and rarely live over the first or second week. It is important that all goods intended for storage in cedar chests should be cleaned, beaten, brushed and sunned in order to remove or kill as many of the moths' eggs and larvae as possible. Special attention must be given to all seams, creases and pockets. Such clothing, if stored at once in good cedar chests, should be sufficiently well protected.

B. K.

(1) The heartwood contains from 2 to 4 per cent of a pale yellowish brown volatile oil of which the principal constituents are alcohol cedrol, the sesquiterpene alcohol cedrenol and the sesquiterpene cedrene; the characteristic odour is probably due to the two former compounds. (Ed.)

1062 - **Belladonna and Foxglove cultivated in the Province of Florence, Italy.** — ALESSANDRI, L. (Laboratorio di Chimica Farmaceutica del R. Istituto di Studi Superiori di Firenze), in *Archivio di Farmacologia sperimentale e scienze affini*, Vol. XXXI, No. 9, pp. 143-144 and No. 10, pp. 145-153. Rome, May 1 and May 15, 1921.

The writer has examined a specimen of *Atropa Belladonna* taken from wild plants at Vallombrosa (950-1050 m.) collected in the months of August and September, which had almost completely fructified, and a specimen taken from 2 year old plants cultivated in experimental plots of the "R. Istituto Forestale alle Cascine" (40 m.), collected in the months of June and July, and obtained by sowing seeds of Vallombrosa wild plants. The quantitative analysis of the alkaloid was made according to the method suggested by CAESAR and LORENTZ. The average of three determinations gave 0.297 % of alkaloid for the first specimen, and 0.192 % for the second; the quantity of moisture was approximately equal for both, viz., 4.66 and 3.95 % respectively. The German pharmacopoea requires, a minimum of 0.30 % of alkaloid and consequently cultivation in the plains has provided a drug with insufficient atropine, while the wild plants of the mountain zone could be used for extraction of the alkaloid.

The writer has also examined three specimens of *Digitalis purpurea*. One of them was taken from plants grown at Vallombrosa from imported seed: the other two came from plants cultivated at the "Cascine" after sowing Vallombrosa seed; in one case they were transplanted, in the other not.

A physiological test was made on frogs, applying FOCKE's method, but using a 5 % infusion instead of 1 %. The effect passing from the second specimen to the first and third was in decreasing order, though between the last two there were only slight differences. The coefficients calculated according to FOCKE's formula were, as average of two determinations: — 0.231 — 0.122 — 0.1255 %. The ultimate chemical test made according to the Italian Military Pharmacopoea which fixes a minimum of 0.14, gave respectively the following percentages of digitalin: — 0.322 — 0.150 — 0.181; the three specimens contained approximately the same quantity of moisture (4.0 — 5.87 — 4.54 %). On the whole, the two series of data agree. They indicate that the cultivation of the foxglove is to be recommended and also that wild plants may be suitable. It is however desirable that further researches should be made and supplemented by quantitative tests, to establish these conclusions.

L. V.

1063 - **Wormseed (*Chenopodium ambrosioides*).** — BRU, P., in *Revue vétérinaire*, Vol. LXXIV, No. 4, pp. 217-225. Toulouse, April 1922.

Wormseed is a plant with the properties of a vermifuge and specially effective against round worms (ascarids, trichocephali, ankylostomes, strongyli, etc.), and as such, largely used in America. In Maryland (United States) *Chenopodium ambrosioides* var. *anthelminthicum*, which is richer in active principles, is specially cultivated. Plants of this variety are 1 m. high, with stiff stalks, branches covered with hairs, narrow leaves, 5 to 7 times as long as they are broad, pointed marginal denticulation; near the end of the stalk, the leaves are shorter and are finally scarcely visible.

[1062-1063]

The floral glomerules are collected in closely packed whorls without bracts and form as a whole, a compact terminal cluster. A strong, penetrating aromatic odour is set free from all parts of the plant, due to an essential oil secreted in the hairs and parenchymatous glands. The American variety is replaced in France by *Chenopodium ambrosioides* var. *subrotundum* very common in the west and south and known locally under the names of Mexican tea, Mexican ambrosia and goose-foot vermifuge. It grows on rubbish heaps and sub-spontaneously with alternate lanceolate leaves, with undulating rather than dentate edges, and wider than those of the American variety; the flowers are greenish and arranged all along the stalk in axillary glomerules. In tropical regions, in Brazil, in the Antilles and in Dahomey a third variety is found: — var. *Sancta Maria* which from a pharmacological standpoint, differs from the preceding varieties as these differ between themselves, only in the content of the active principle.

Plants of *Chenopodium* contain a volatile essential oil (essence of *Chenopodium*) composed of ascaridol $C_{10}H_{18}O_2$ (65 % on the average), cymol (22 %) and dioxyterpen. The active principle is ascaridol. The essence is obtained by distillation of the seeds or the tops of the plant when they have almost reached maturity. The writer describes its therapeutic and other properties.

R. F

HORTICULTURE 1064 - **Vegetable Growing in Island of Guam.** — BRIGGS, G., in *Guam Agricultural Experiment Station, Bulletin No. 2*, pp. 1-6c. Washington, June 1922.

Before the occupation of Guam by the United States, only a very few vegetables were grown by the natives. Since then distinct progress has been made throughout the island. Nearly all the common vegetables can be grown. However, methods adopted for the various crops in the temperate zone generally require some modification in the Tropics; seeds often fail to germinate or the plants do not yield any fruit.

Owing to the lack of definite information concerning tropical horticulture, the Guam Agricultural Experiment Station has undertaken the development of this work since its establishment in 1909. The methods to be adopted are based on the results obtained and are given in detail in the bulletin under consideration.

Amongst other points discussed are included: suitable soils; seed; manures and fertilisers; preparation of seed-bed; planting; cultivation; fences and windbreaks; diseases and pests; detailed cultural directions for the various crops: viz. acelga (*Beta cyclo* and *B. vulgaris cyclo*); amargoso (*Momordica charantia*); arrow-root (*Maranta arundinacea*); Asparagus (*Asparagus* sp.); banana (*Musa sapientum*); lima beans (*Phaseolus lunatus*) and variety "chochomeco" etc.; cowpea (*Vigna sinensis*) and variety "fijole"; cerebilla (*Doichos lablab*); seguidilla (*Psophocarpus tetragonoloba*); mungo (*Phaseolus aureus*); maize cabbage; calabaza (*Lagenaria vulgaris*); carrot (*Daucus carota*); cassava (*Manihot manihot* (= *M. utilisima*)); chayote (*Sechium edule*); collards (*Brassica* sp.); condor (*Benincasa cerifera*); cucumber (*Cucumis sativus*); egg-plant (*Solanum melongena*); horse-radish (*Cochlearia armoracia*); lettuce; mint; musk-

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melon (*Cucumis melo*); mustard (*Brassica juncea*); okra (*Hibiscus esculentus*); onion; papaya (*Carica Papaya*); parsley; patola (*Luffa aegyptiaca*); peas; pechay (*Brassica chineis*); peppers; pigeon pea (*Cajanus indicus*); plantain (*Musa paradisiaca*); potatoes; *Cucurbita* spp.; radish (*Raphanus sativus*); roselle (*Hibiscus sabdariffa*); spinach (*Spinacia oleracea*); sweet potato (*Ipomoea Batatas*); taro (*Colocasia esculenta*); tomato; turnip; water melon (*Citrullus vulgaris*); yam (*Dioscorea* spp.); yam bean (*Pachyrhizus tuberosus*).

F. D.

1065 — **Cultivation of Citrus Fruits in Rhodesia.** — TURNER, A. G., in *Department of Agriculture, Salisbury, Rhodesia, Bulletin* No. 424, 23 pp. Salisbury, June 1922.

ARBORICULTURE

During the last 5 or 6 years, great progress in citrus fruit cultivation has been made in several parts of Rhodesia. The great problem to be solved is that of transport; in 1921, only part of the consignments received at the various ports could be shipped. The author advised co-operation amongst the growers as being the best means of overcoming the difficulty, and in the first half of 1922, a co-operative Society was founded known as the "Fruit Growers' Exchange of South Africa, Ltd." In spite of the lack of tonnage in 1921, about $\frac{1}{3}$ of all the citrus fruit exported that year by the whole Union of South Africa (240 000 cases), came from Rhodesia and the exports this year are expected to be twice as large.

The average prices fetched by Rhodesian oranges in 1921 were as follows: — wholesale price in England 23 shillings per case; in Rhodesia, the price was 16/6 net (i. e. after deduction of the costs of railway carriage and freightage, lading and unlading charges, commission etc.); in the orange gardens, the fruit was sold for 10 shillings per case. These oranges find a ready sale in Europe, for they come on the market at a time when other oranges are not available.

One case of first-class fruit can be obtained from an orange tree 10 years of age, while the crop of a tree in full bearing, viz. when 10 years old, will fill three or four cases.

The author studies the following questions: choice of locality — election of varieties, the following being recommended as being most in demand by the export trade: Washington Navel — Valencia Late — Navel — Joppa — Mediterranean Sweet — Paper Rind St. Michael; the two first being special favourites — planting an orange garden — irrigation — cultivation — manuring — pruning — spraying and fumigation.

F. D.

1066 — **Vine-Growing in Alsace.** — BURGER, G., in *Progrès agricole et viticole*, Year 39, No. 23, pp. 544-548. Montpellier, June 3, 1922.

VINE GROWING

The area cultivated under vines in Alsace is 20 000 ha. The production is somewhat variable, being 725 000 hl. in 1920 and 368 850 hl. in 1921, and white wines are estimated to make up 90 % of the total production.

Alsatian table wines are distinguished according to the vines. Ordinary wines are produced by: — Bourgeois, Chasselas, Knipperlé, Silvaner. They resemble German Moselle wines. Fine wines come from the vines:

[1064-1066]

— Gentil, Riesling, white Pinot, Traminer, and resemble the German Rhine wines. The most famous districts are:— Ribeauvillé, Riquewihr, Ammerschweiler, Mittelwihr, Hunawihr, Beblenheim, Turkheim, Eguisheim, Rouffach, Guebwiller in the Upper Rhine; Barr, Kinzheim, Dambach, Molsheim, Obernai in the Lower Rhine.

The wines of Alsace are characterised by fine bouquet combined with a pleasant acidity and are of a mellow type. These good quality wines represent a new class for France, the Alsatian wines bring of a different character from the French.

Their cost is generally high, owing to the amount of manual labour required for production. Alsatian wines must therefore try to take the place of the old German wines in the market, mainly in the markets of Paris, Belgium and England.

P. C.

FORESTRY

1067 — **Mangrove Swamps in the Dutch Indies.** — BECKING, J. H., DEN BERGER, L. G. and MEINDERSMA, H. W., in *Tectona*, Vol. XV, No. 7, pp. 561-611, 2 figs., bibliography of 22 publications. Buitenzorg, July 1922.

In the Dutch Indies, mangrove swamps are found on the coasts which are less exposed to the open sea such as those of the bay, delta and internal seas and especially on more or less muddy lands subject periodically to sea water flooding. It is not known exactly whether the mangroves improve the fertility of the soil, and they are probably only a secondary factor. Various morphological and physiological characters result from these conditions. SCHIMPER called the mangrove xerophytic because of the high saline concentration which the plants must endure and of their low moisture evaporation. However HOLTERMANN and VON FABER proved that transpiration could be considerable so that SCHIMPER's theory is not entirely accurate.

The swamps in which the mangroves grow and their periodic submersions render special organs of transpiration necessary and these are generally represented by the roots. The pneumatophores are roots or portions of roots which are transformed and provided with organs of transpiration or lenticels.

Many species are viviparous. The seeds germinate on the tree and take root when they fall into the mud. They can float for a long time without sinking in the water like the fruits of non-viviparous plants. The number of species is limited. In the Malay archipelago there are reckoned to be 28 and conspicuous among them are *Rhizophora*, which grows on the sea coast, *Bruguiera* and others which grow in the interior and on less marshy land.

The writer also gives indications for identifying the species of mangroves. He describes the various genera, indicating their chief properties and describing the wood as it appears under an ordinary pocket lens.

The descriptions are summed up diagrammatically in 10 tabular statements containing respectively:— 1) the diameters of trees of normal growth — 2) a list of the values of the various timbers according to the scheme of classification of the Buitenzorg experimental forestry station —

(1066-1067)

3) the method for determining the wood with the use of a pocket lens — 4) a list of the values of the various woods as fuel — 5) a classification of fuels — 6) a tabular statement for determining the wood — 7) a tabular statement for determining the fuel — 8) the working of the fuel in the Dutch Indies — 9) a tabular statement of the tanning qualities of mangroves — 10) a tabular statement for valuing tanning barks.

By means of a few examples, the writer shows the importance of the exploitation of tanning barks in the Malay archipelago and furnishes information regarding the manufacture of cutch. The commerce in mangroves is done on a large scale but with systems which are not yet economical.

A. d. B.

1068 — **Wooden Chests made of *Juniperus virginiana* for the Protection of Insect Attack on Clothes.** — See No. 1061 of this Review.

LIVE STOCK AND BREEDING

1069 — **The Screw-Worm Fly (*Cryomyia macellaria* Fabricius) and other Diptera parasitic on Stock in the United States.** — BISHOPP, F. C., MITCHELL, G. D. and FARMAN, D. C., in *United States Department of Agriculture, Farmers' Bulletin* 857, pp. 3-19, figs. 7. Washington, January 1922.

HYGIENE
OF CATTLE

The screw-worm fly occurs from the extreme southern part of South America northward into Canada, but it seldom becomes abundant in the Northern States being chiefly found in the warmer parts of the Union (Texas, Oklahoma, New Mexico, Arizona and Southern California) where it causes enormous losses to the stock raisers. The various stages of the insect are so well known that it is unnecessary to describe them.

The fly appears (according to the latitude and the season) from the first of April to the middle of June.

The insect decreases in numbers in July and August unless the weather is cloudy and rainy, but again becomes abundant in the early autumn, its activities only ceasing with the heavy frosts. A warm humid atmosphere is best suited to its development.

Chrysomya macellaria breeds in decaying matter, especially the carcasses of large animals, and if these could be disposed of properly, no cases of infestation of living animals would occur. Practically however all animals are more or less subject to attack and it infests in decreasing order of frequency cattle, hogs, horses, mules, sheep, goats and dogs. Numerous cases of the infestation of human beings have been recorded.

The eggs are deposited in the wounds of living animals and the young larvae, as soon as they hatch out, burrow into the flesh of their host excreting an irritating substance that breaks down the tissues and may result in the general poisoning of the system. Sometimes calves are attacked at the time of birth when the worms penetrate the navel. At a later stage, infestation takes place by way of the mouth occasionally resulting in loss of teeth or in death. Generally the flies are attracted by coagulated blood, and infestations occur after surgical operations

[1067-1069]

(castration etc.) or after serious attacks of other parasites (ticks, horse-flies etc.). In severe cases, where there are an enormous number of larvae, the host loses appetite, becomes emaciated and hides in the undergrowth. While fatal cases are not infrequent, most of the loss is due to the reduction of flesh, the expense entailed in treating the animals and the money spent on screw-worm medicines.

CONTROL MEASURES. — The best method of control is the burning of any dead animals; this not only stops the breeding of all blow-flies, but prevents the dissemination of dangerous diseases e. g. anthrax, black-leg and hog cholera. The method of burning the carcasses depends to some extent upon the locality. It is desirable that the carcasses should be burnt on the spot, and in cases of anthrax this is essential. If burning is impracticable, the carcasses may be buried beneath at least 2 ft. of closely packed soil. Should it be absolutely impossible to burn or properly bury a carcass, many of the maggots may be destroyed by exposure to the sun.

PREVENTIVE MEASURES. — Even in the most heavily infested districts, losses from screw-worm at calving time can be largely avoided by arranging for the cows to calve between December 1 and the middle of April. In the northern regions, this time may be extended from about November 1 to June 1 (1). Branding and castration should be carried out between December 1 and May 1; greater care should be taken in handling the cattle, and the de-horning period ought to be shortened. As supplementary measures, the following may be advised *a*) the destruction of ticks; *b*) the clearing of the brush and undergrowth; *c*) the use of poisoned bait and traps for the destruction of the adult insects.

TREATMENT OF INFECTED ANIMALS. — It is important that herds should be watched carefully during the screw-worm season. Those familiar with the injury caused by the parasite can easily tell if a wound is infested, for there is usually a free discharge of watery blood and the wound appears as if recently caused. For destroying the larvae in a wound there is nothing better than chloroform; a deep lesion should afterwards be cleaned out with water containing 5 % carbolic acid; tannic acid followed by pine-tar or some of the creosol dips being afterwards applied as a repellent for flies.

Although only the larvae of *Chrysomya macellaria* penetrate the sound tissues of living animals, the maggots of the black blowfly (*Phormia regina* Meig.) and of the green-bottle fly (*Lucilia sericata* Meig.) infest the wool of sheep while those of the flesh-fly (*Sarcophaga* spp.) attack suppurating wounds.

The above three species are carrion breeders and only when very numerous do they infest wounds on living animals; the best means therefore of controlling them are those already recommended in the case of *Chrysomya macellaria*.
E. F.

(1) This would of course mean a change in the present practice of leaving the bulls with the herd continuously. (*Authors' Note*)

1070 - **Splenic Inflammation of Pigs in Prussia and the Causes of its increased Frequency.** — WIEGMANN (Reg. und Veterinariat, Berlin), in *Berliner tierärztliche Wochenschrift*, Year XXXVIII, No. 15, pp. 169-171. Berlin, April 13, 1922.

In 1912, ELSÄSSER and SIEBEL (1) called the attention of breeders to the rapid and extraordinary increase in cases of splenic inflammation of pigs in Prussia; the same year the Prussian Ministry of Agriculture and the Imperial Bureau of health caused researches to be made regarding the causes of the increased frequency of this disease; they made a careful microbiological examination of anatomical material taken from 238 cases. These are classed by the writer in 4 groups (according to the gravity of their anatomopathological injuries and the diffusion of the germs) and tabulated according to their origin.

Regarding the origin of the disease, it was evident that it should be looked for in the foods given to the animals and especially in those coming from foreign countries. The latter in fact formed a very considerable portion of the food of the pigs, especially in Hanover and Schleswig-Holstein, because in these countries the fattening of pigs had increased to such an extent that the local production of barley was insufficient for the feeding requirements and it was in those districts that cases of the disease were most frequent.

Subsequent researches indicated fish meal ("Fischmehl") as the probable vehicle of the pathogenic germs, a food consumed in large quantities, because it was cheap and at the same time considered to be very nourishing; however under normal conditions, it proved to be free from bacteria. It was then thought that the fish meal might be adulterated by the addition of substances containing the germs of splenic inflammation, and sufficient evidence was soon collected to detect bone meal of Indian origin ("indisches Knochenmehl"). The Prussian Government ordered extensive investigations to be made to ascertain definitely: — (a) whether the fish meal was manufactured in infected localities, and how it was made — (b) whether other matter was mixed with the fish meal either at the place of production or in trading, and if so, the nature of that matter — (c) whether foreign or only local fishmeal was ordinarily found on the market and whether the foreign meal was sold to the public after undergoing special manipulation or mixture with other products. These enquiries led to a definite result: among the numerous samples sent in for examination at the Institute of Hygiene at the Veterinary College at Berlin, a large percentage of samples of fish meal contained bone meal, which in almost all cases contained germs of the disease.

It was then ascertained, both in Prussia and in other States of the Empire, that certain large manufacturing firms constantly adulterated the fish meal with considerable quantities of Indian bone meal and it was understood that the danger of this product was already known by the Governments

(1) ELSÄSSER and SIEBEL, Ueber die gesundheitspolizeiliche Beurteilung des Fleisches bei lokalem Milzbrand bei Schweinen, in *Zeitschrift für Fleisch u. Milchhygiene*, 1912, No. 8-9. [Author's note]

of the United States and of New Zealand, who had prohibited its importation. Another proof of the fact that the increased frequency of splenic inflammation in pigs was due to the adulteration of the food with bone meal was afforded during the war, which prevented the importation of this product:— the number of cases of the disease which was, for the whole of Germany, 2706 in 1914, fell to 112 in 1915, to 133 in 1916, to 34 in 1917 and to 30 in 1918. E. F.

ANATOMY AND
PHYSIOLOGY

1071 - Experimental Contribution to the Knowledge of the "Working Conditions" of Draught Animals under different Dietary Conditions. — ALBERTONI, I. in *Le Stazioni sperimentali agrarie italiane*, Vol. LV, No. 4-5-6, pp. 173-262, bibliography of 46 publications. Modena, 1922.

Work done at the Royal College of Veterinary Medicine at Bologna.

After a wide review of present knowledge on the subject of the influence of different rations on the "working conditions" of draught animals, the writer describes his experiments on this question.

The following points are considered:—

I. — VARIATIONS OF THE PERCENTAGES OF GLYCOGEN AND OF GLUCOSE IN THE MUSCLES OF THE FRAME AND OF GLYCOGEN IN THE LIVER, UNDER THE INFLUENCE OF DIFFERENT DIETS. — 1) *Importance of glucose and glycogen for muscular contraction.* — 2) *Quantities of glucose and glycogen which may be found in the animal organism.* — 3) *Quantities of glucose and glycogen which may come from the ration: how much of them the ration should contain in order to supply them again to the muscles.* — 4) *Origin of the glucose of non-nitrogenous extracts and of crude cellulose.* — 5) *Origin of the glucose of proteins and of fats.* — 6) *Summary on the capacity of the ration of herbivorous animals to supply glucose to the muscles: "The rations of our herbivorous animals in which for hygienic and economic reasons, carbohydrates always predominate, should be such that they are able to maintain in the muscles the maximum quantity of glycogen which they can contain if, apart from the chemical relationship of simple foods to glucose, other causes which may influence that formation do not intervene."* — 7) *CHAVEAU's theory on the production of work.* — 8) *State of nutrition of animals and their provision of glycogen.* — 9) *Method of research followed in these experiments.* According to CHAVEAU's theory on the production of work: — 1) Glucose is the immediate food of the intramuscular combustion of work — 2) Glucose can be derived from carbohydrates, albumens, and fats — 3) The food materials replace one another by isodynamic weights.

CHAVEAU considered glucose as being derived from fats by incomplete oxidation and from albumens by hydrolysis with the formation of decomposition products utilisable as plastic material. In each case there would be a loss of energy, but the numerous and conclusive experiments of ZICHT, of his collaborators ATWATER and BENEDICT and other scientists lead to the conclusion "that, in the development of force nutritive substances replace each other in proportion to their provision of utilisable energy."

The experiments of the writer do not relate to this question "except

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from the practical stand point, at least, it may be considered as solved," but to the choice of foods for the production of work.

He proposed to determine "which are the foods that enable an animal to return the total output of work that may be expected from their composition; which are, in short, the foods which will best maintain an animal in a condition for work and by what means they may be able to influence it." In these experiments the animals had been kept resting and well fed, sometimes even *ad libitum*.

II. — PROBABLE CAUSES OF VARIATION OF THE PERCENTAGE OF GLYCOGEN IN THE MUSCLES.

III. — 1) *Choice, description and analysis of foods.* The writer used:— pasture, grass hay (almost exclusively of *Dactylis glomerata*), lucerne, oat grain, beans, maize, rice, barley; as protein food, Emmental cheese; as fatty food, lard) — 2) *Composition of forages, such as is determined by analyses and its importance in regard to these researches.* — 3) *Choice of animals, their preparation for feeding experiments, distribution of rations, observations regarding the behaviour of the animals.* — 4) *Methods employed for the quantitative analysis of glycogen in the muscles and in the liver, and for the quantitative analysis of glucose in the muscles.* For glucose:— extraction of the muscle by repeated boiling, filtration of the broth, defecation with excess of nitrate of mercury, filtration, precipitation of the reagent excess by a current of sulphuretted hydrogen, filtration, neutralisation and concentration of the liquid, quantitative analysis of glucose according to ALLIEN's method; for the determination of glycogen PFLÜGER's method was used.

IV. — DESCRIPTION OF THE EXPERIMENTS: — 1) on horses — 2) on rabbits — 3) on guinea pigs — 4) on white rats.

The results of experiments made on the horse and the mule are summed up as follows: — 1) The ration of pasture grass and oats produced a greater quantity of muscular glycogen than the ration of pasture or of oats alone. — 2) the diet composed only of grass hay and straw given in sufficient quantity for the nourishment of resting animals, produced very much less glycogen in the muscles than the maximum which could be found in them. — 3) The addition of oats and rice to the maintenance ration, composed of grass hay and straw, considerably increased the amount of muscular glycogen. — 4) Oats and rice, each given in proportion to the nutritive units which they contain, produced in the horse and the mule different quantities of glycogen. — 5) The semi-tendinous muscle of the horse and the sterno-humeral examined on the same animal and at the same time showed a remarkable difference in the percentage of glycogen: 23.5% more in the former than in the latter. — 6) The mule did not reach the percentage of muscular glycogen of the horse fed on the same ration; the latter exceeded the mule by about 68%. — 7) A horse kept on pasture only at first, and oats only afterwards, showed a negligible difference in the quantities of glucose contained in the semi-tendinous muscle (3.88 and 3.66 per 1000 respectively).

V. — 1) *Influence of the percentage of protein in the ration on the pro-*

duction of muscular glycogen: from most of the experiments made up to the present, it results that the protein ration, especially if it is not deprived of carbo-hydrates, is favourable to the production of glycogen — 2) *Nitrogenous foods in the practical feeding of working animals*. — 3) *Conclusions regarding the influence of the quantities of proteins in the ration on the sources of muscular energy*. — 4) *Foods rich in carbo-hydrates*.

Casein renders the muscles of rats rich in glycogen: the fat in which it was administered and the excellent state of nutrition of the animals did not prevent the deposit of a considerable amount of glycogen in the muscles. Using other protein foods ROSEMBERG and MERING got the same results, while SEITZ, with ducks overfed with albumen, found the glycogen reduced to traces and replaced by fat: apparently, it may therefore be concluded that proteins do not all behave in the same manner for the production of the two principal substances of muscular reserve. "It remains to be ascertained experimentally whether it is necessary to make a distinction between the proteins which produce glycogen in the muscles and those which produce fat, or whether the formation of fat in the liver and the corresponding disappearance of glycogen are produced when proteins alone are fed continuously in large quantities, so that an alteration of the chemistry of the fat may result.

Decrease in the quantity of carbohydrates to the advantage of proteins in the ration of herbivorous animals in no way hinders the production of glycogen (which is largely assured by the rest of the ration); it is even favourable to it in an indirect manner, for a large quantity of protein in the ration insures to the protoplasm of the muscular fibres the maximum power of accumulating reserve substances. Abundant feeding does not always cause, by the fattening it entails, a decrease of glycogen in the muscles. The diet of rice produces, both in the muscles and in the liver, a large quantity of glycogen, so long as the percentage of protein in the ration does not decrease below what is sufficient to balance the nitrogen requirements of the animal, or so long as it is maintained above that limit. It may even happen that foods with a carbohydrate basis, well known to be producers of glycogen (those for example, which are composed essentially of barley, maize, sugar, and probably also those with potatoes, chestnuts, carob, foods with wide nutritive ration) do not produce glycogen in the muscle because they are insufficient to maintain, in the muscular fibres and in the circulation of the muscle, the reserve which maintains the turgescence of the cells, and which is very probably the necessary condition to enable the muscular protoplasm to preserve, to a high degree, the fundamental metabolism, the power of elaboration and the faculty of accumulating non-nitrogenous energetic substances. It is thus explained how rations in which carbohydrates predominate may be less suitable than protein rations for the production of sources of muscular energy and consequently of work, in cases of serious impoverishment in nitrogen of the whole organism, e. g. race horse in the period of training, acclimatisation crisis, breeding season, etc. In all these cases, eggs, meat, dried blood may prove the best restorers of strength and may be preferred.

VI. — (1) *Probable causes determining the difference of production of muscular glycogen, between diets composed of carbo-hydrates, and applications of the technology of work, resulting from that difference of behaviour.*

The experiments of the writer lead to the conclusion that common foods have different physiological values. Using the results obtained with rats and making the productivity of muscular glycogen from rice equal to 100: barley was 100 — cheese 72.4 — maize 69.00 — oats 57 — lard 4 — beans 32.75. The quantity of muscular glycogen which is found in animals subjected to various diets compared with an equal quantity of glycogen of the liver is distinctly different: high in a rice diet (10.2 — 3.54 %) and still higher in a cheese diet (14.8 — 41.30 %) and a diet of bacon (26 %), it falls to 9.2 — 6.17 % in a diet of oats, and to 8.2 — 6.4 in that of beans. If the physiological values of several foods are considered we reach the surprising fact that the rations universally preferred for working animals are the least suitable for producing glycogen in the muscles: thus rats and beans produce less glycogen than rice and barley. "We are therefore led to admit that an animal may be in full possession of its strength while having but little glycogen; and it may be in an excellent state of nutrition without having its maximum reserve of glycogen. The writer considers that diets rich in carbo-hydrates such as were largely given in his experiments, were sufficient to maintain the animals in an excellent condition of nutrition, although they were poor producers of glycogen, and gave muscles rich in fat; those, on the other hand, which have favoured the production of glycogen, gave muscles less rich in fat.

2) *Working condition of draught animals fed with rations producing different quantities of glycogen.* — "Generally it may be said that glycogen favours the functional efficiency of muscular tissue and that, by assuring the greatest rapidity of chemical, functional and restorative reactions, it favours in that way the rapidity of contraction".

3) *Importance of the quantity of reserve substances in the muscle for the working condition of animals.*

4) *Frequency of contractions and provision of oxygen in the muscles.*

5) *Of different working conditions in which the muscle may find itself under the influence of diet which is to be preferred?*

Should the formation of glycogen or of fat be preferred in the muscle? In other words should we prefer respectively feeding with a basis of barley, wheat, sugar, carobs, or with a basis of seeds of leguminous plants, or with a diet of oats, the action of which is intermediate between those of the other two diets?

The muscle which consumes fat, for an equal quantity of energy used, gives the same output as the muscle which consumes glycogen; and besides, it accumulates in the muscles in greater quantity because it is deposited in such a way; glycogen combines with 2 or 3 times its weight of water; fat, further, has a calorific power equal to 2.4 times that of glycogen.

If therefore we consider the problem of the sources of muscular energy from the sole standpoint of the amount of energy, the feeding of the animals should have as basis the use of substances forming muscular fat.

But glycogen has a very peculiar signification for the optimum output of the muscles and for sudden muscular contraction; it may apparently, be said that, when sufficient glycogen can be accumulated in the muscle for accomplishing a required work (the work not being very prolonged or else the animal having the power to store glycogen in large quantity), it is rational to procure its formation. When the work is intense and difficult for the means at the disposal of the animal a diet permitting the formation of a sufficient quantity of glycogen should also be chosen. Lastly, the choice of a food producing a large amount of glycogen might also be rendered necessary by hygienic reasons, for example to maintain a higher percentage of moisture in the tissues. Consequently the choice of the food will depend: — 1) on the intensity, the duration and the nature of the work — 2) on the aptitude of the animal to store up one or the other reserve substance; that faculty depends on the species, race (among horses the Eastern races and their derivatives tend to store up glycogen more especially whereas draught breeds store up fat), climate, sex, etc. — 3) on other factors which determine the working conditions, such as temperament and the quantity of haemoglobin.

6) Some of the specific effects on the working condition of animals attributed to foods, find their explanation in the results of these researches

F. D.

FEEDS AND FEEDING

1072 — **Rules for Feeding Cattle.** — SCARAMUZZI, D. in *Le Stazioni sperimentali agrarie italiane*, Vol. LV, Nos. 4-5-6, pp. 109-124. Modena, 1922.

In order to give rules to the farmer who neither wishes to waste forage nor to make unintelligent economies, the writer, using mean analytical data contained in the treatise by Professors MENOZZI and NICCOLI, *L'alimentazione del bestiame*, has calculated the percentage proportions of different foods to be used, so as to obtain a ration the nutritive ratio of which decreases successively from 1 : 4 to 1 : 2.

As foods, he has taken into consideration those which have the greatest importance for southern Italy, that is to say all the mixtures which it is possible to form by combining two of the following feeds: — clover hay — vetch hay — straw of cereals — bran — oats — carobs — beans — refuse of olives — husks of grapes — linseed cake. F. D.

1073 — **Use, as Cattle Food, of certain Waste Products from Chick-peas, Peas and Beans.** — LAY, C. (R. Stazione chimico-agraria di Torino), in *Le Stazioni sperimentali agrarie italiane*, Vol. LV, No. 4-5, pp. 125-128. Modena, 1922.

CHICK-PEAS. — Of the numerous varieties of chick-peas grown in Italy, some have seeds with hard teguments, so that they must be decorticated for use as human food. Such are the chick-peas with black or red tegument, grown especially in the Province of Bari (annual Italian production 7000-8000 q.) and prepared for use in Piedmont with modern machinery. From these peas are obtained about 75 % of endosperm ("cicerata") and 25 % of waste material from decortication, composed about half of tegument and the rest of endosperm. The waste material is used as cattle food either as it is or mixed with bran or with milling refuse.

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For sheep, these waste materials are generally first moistened; to horses they are fed dry; for young pigs, they should be ground very fine. Price: — wholesale 79 *lire* the quintal; retail 90-95 *lire* the quintal.

From the analysis of two samples of decortication waste, one of black chick-peas and the other of red chick-peas, the writer obtained respectively the following percentages:— Hygroscopic moisture by drying at 100°, 11.90 — 10.76; Proteins ($N \times 6.25$), 5.25 — 6.20; Ash, 5.24 — 5.28; Crude fats, 0.42 — 0.95. Cellulose, 27.86 — 25.10; Nitrogen-free-extracts, 49.33 — 51.71; Pentosans, 15.81 — 14.90.

The ash contained:— Calcium oxide 46.29 — 45.30; Potassium oxide 26.52 — 25.38; Magnesium oxide 16.08 — 16.98; Phosphoric acid 2.66 — 3.02 %.

BEANS. — On decortication in the machine, the beans yield 68-74 % of endosperm and 26-32 % of tegument with a loss of about 2 %, whereas by hand about 85 % of endosperm and 15 % of tegument are obtained. The decortication waste of beans with the machine contains therefore about one half endosperm waste; the price is the same as for the chick-pea waste. Percentage composition of the endosperm and of the teguments respectively:— Moisture 11.81 — 12.43; Proteins ($N \times 6.25$) 27.81 — 9.25; Fats 1.53 — 0.21; Cellulose 3.02 — 30.15; Ash 3.53 — 2.85; Nitrogenous-free-extracts 52.30 — 45.11; Pentosans, 4.50 — 4.28.

PEAS. — Decortication in the machine gives 55-60 % of cleaned seed (endosperm) and 40 — 45 % of tegument, against 80 % of endosperm and 20 % of tegument by hand decortication. The price of the decortication waste is the same as in the case of chick-peas. Percentage composition of the endosperm and tegument respectively:— Moisture 11.05 — 11.15; Proteins ($N \times 6.25$) 23.62 — 7.18; Fats 1.24 — 0.75; Cellulose 1.35 — 29.73; Ash 2.76 — 3.00; Nitrogenous-free-extracts 58.98 — 48.19; Pentosans, 4.96 — 19.58.

CONCLUSION. — The waste products of decortication by machine of chick-peas, beans, peas constitute excellent cattle foods, as they consist, to the extent of about one half of fragments and flour of the internal part of the seed (endosperm).

F. D.

1074 - **Improvement of Stock Breeding in Morocco.** — VELU, H., in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. VIII, No. 26, pp. 736-740. Paris, 19 July 1922.

The improvement of stock breeding methods in Morocco depend mainly:— (a) on the possibility of increasing the herds — (b) on a definite aim in breeding, in order to specialise in the production of cattle, pigs and sheep — (c) on the choice of methods to be adopted to obtain the necessary improvements in quality.

The great factors which are outside human control and which must be taken into account at the outset and in the course of the work, are essentially the climate and the parasitic organisms or carriers of disease. As in all hot countries, environment is of the greatest importance. Diseases,

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even the gravest and the most common, are largely dangerous because they attack animals which the climate has reduced to a state of bad health and vital exhaustion. In Morocco animals die mainly of hunger in summer, of hunger and cold in winter (1).

The organisation for the control of numerous internal and external parasites is also a factor of essential importance. Preventive measures against external parasites are almost exclusively based on arsenical dips: the writer therefore advises that the sale and use of soluble crude arsenical products should be allowed in Morocco. The control of internal parasites, which is more difficult, requires the adoption of enclosed areas and the removal of stock from pastures in order to interrupt the cycles of development of parasites which have no intermediate hosts and to destroy these hosts when they exist.

In conclusion, breeding in Morocco, depends on the organisation of preventive measures against disease and modification of the environments which favour the development of parasites. The improvement of environment is an economic problem, for it is a case of ascertaining whether extensive breeding is possible in Morocco or whether it must be replaced by semi-stall rearing. The control of parasites is further a problem of colonial policy, for, to put it into practice, the hostility of the natives must be overcome.

E. F.

CATTLE

1075 - The Work of the Central Syndicate for the Exportation of Charolais Cattle. — HIRIER, H., in *Bulletin de la Société d'encouragement pour l'industrie nationale*, Vol. 131, No. 7, pp. 617-621. Paris, July 1922.

The Charolais breed of cattle which is particularly common in the Departments of the Allier, the Cher, the Indre, the Loire, the Nièvre and Saône-et-Loire, is considered to be one of the best breeds. Shortly after the end of the European war, the local breeders, with the object of making their produce known abroad and to induce cattle-breeding countries to use them to improve their herds, constituted a federation of the various agricultural societies and syndicates of the above-mentioned Departments. This federation adopted the name of "race charolaise" as official title, and grouped in a single "Herd-book of the Charolais breed for the Nièvre, Saône et Loire and adjacent Departments" the local genealogical books which had been founded since 1887. They formed subsequently the "Syndicat d'exportation de la race charolaise" as an agency to study the means of establishing relations with foreign markets and to undertake the sale of breeding animals.

The publication reviewed is a report on the work of this Syndicate, which first printed and distributed a propaganda pamphlet, accompanied

(1) Drought, the high cost of forage, the brackish water given for drinking, cause collectively chronic and often fatal digestive troubles. The syndrome which results forms the subject, from a strictly veterinary standpoint of another publication by the writer. (Summer-autumn mortality and its relationship with the influence of environment in Morocco, in *Revue de Zootechnie*, No. 9, pp. 897-900. Paris, June 1922, which reproduces, in part, the considerations which have just been related above). (Ed.)

by photographs and translated into several languages, and it next took into consideration the necessity of sending to the countries of export a number of breeding animals selected with a view to attract the attention of breeders. Owing to the assistance of several private breeders, the Syndicate was able to overcome initial financial difficulties and it at present, is dealing with the inoculation of some breeding animals destined for Brazil and other South American States, where *tristeza* (piroplasmosis) is raging.

E. F.

1076 - **The Identification of Cattle by Means of Nose-Prints.** — PETERSEN, W. E., in *Journal of Dairy Science*, Vol. 5, No. 3, pp. 249-258, figs. 6, Baltimore, May 1922.

The various breeding associations have always been confronted with a serious problem in the proper identification of animals for registration and of animals on official test. All other means having proved unsatisfactory, O. H. BAKER, of the American Jersey Cattle Club, suggested using nose-prints for the purpose. The author describes the method of taking the prints and the best way of identifying the prints so obtained. The most satisfactory results were given by mimeograph news-print paper and black stamping-pad ink. From different tests made with some 350 cattle the author drew the following conclusions: 1) no two animals have identical pattern nose-prints, therefore these prints will enable positive identification; 2) the taking of nose-prints is simple enough to be practical; 3) it is possible to identify prints as being of the same animal, even if they are not perfect; 4) the pattern remains the same through life; 5) this test is practical for the identification of cows on official test and may prove valuable in connection with the registration of all solid colour cattle; 6) the method affords a positive means of identification when claim for loss is made under livestock insurance policies. F. S.

1077 - **Studies on Reproduction of Cattle.** — I. GRAU, A., L'âge de la reproduction chez l'espèce bovine, in *Revue de Zootechnie*, No. 9, pp. 869-880. Paris, June 15, 1922. — II. MAC CANDLESH, A. C., Studies in the Growth and Nutrition of Dairy Calves, in *Journal of Dairy Science*, Vol. V, No. 3, pp. 301-321. Baltimore, May 1922.

I. — **THE REPRODUCTION AGE IN CATTLE.** — While it is indispensable, in a well managed breeding establishment, to breed from the best animals, it is also necessary to consider at what age breeding should take place.

Bulls. — From what age in the life of the animal and up to what age should a bull serve? About the age of 2 years service may take place almost daily without harm, but the number of cows which one bull can serve would be fifty or sixty at most. It is only very vigorous bulls reaching their third year who can annually serve as many as 80 or 100 cows. Also if service takes place during part of the year only it will be necessary to reduce the number of cows which the bull can cover. This is why in the case of an important herd the proportion of one bull for every 50 cows is desirable.

It may be profitable to replace a full grown bull by a younger bull, a year old, which will grow and which will pay for its keep by its increased value while growing. The advantage of retaining the full grown bull is

that its capacity is known whereas that of the young bull is not, however good may be its appearance.

It would be a serious economic error to apply strictly to the male breeding animal the famous doctrine of making use of cattle during the period of growth. That idea may be extended to oxen kept almost up to 4 years old for beef or else for working up to 4 or 5 years and then to be fattened.

The bull however is the founder of the herd and should be kept as long as possible from the time that it becomes a source of improvement. It is possible to maintain a bull in good breeding condition if it is allowed to run in the fields at times, instead of being kept always in a stall. Should this not be possible, the bull when full grown ought not to be over-fed or it will become too fat.

Hay would form a suitable basis for a ration with a few oats as an addition; but no cake should be given. If it is desired to obtain strong, healthy animals in the herd, it is absolutely necessary to pay close attention to the food of the selected bull, increasing it when young so that the bull may grow up quickly but restricting it from the age of about two years and a half so that the animal may not become too fat.

Cows. — For cows the breeding age is, so to say, the inverse of that for the males. Would it be profitable to make cows calve as early as possible in their second year or would it be better to await the third year? The writer quotes good reasons urged by partisans of both methods. In his opinion the best rule for breeding is that under which the animals are free in their movements and have plenty of fresh air.

Moreover grass is often considered the ideal food and with it the essential function of the organism will be best accomplished, the blood will be richer and development will be better assured. The young cows should be suitably fed and should go out to pasture to the greatest extent; there would certainly not be any harm in arranging that they should have their first calf between the ages of 28 and 30 months. In the case of dairy cows, not only would one calf and one period of lactation be gained, but their subsequent yield would be increased.

Cows belonging to a dual-purpose breed should not have their first calf until about 3 years old. In the special case of a select herd, there may also be occasion not to send to the bull before 18 months but to wait for 6 or 12 months according to whether it is a question of a dairy breed or not. Certainly better animals would be obtained and better qualities might be developed.

The writer advises that good bulls and cows should be kept as long as possible, and that the inferior animals should not be retained for breeding.

II. — STUDIES IN THE GROWTH OF DAIRY CALVES. — 1) *Duration of gestation.* — The variations of the period of gestation have hitherto been little studied. The writer quotes researches made on this subject by SPENCER, WING and FLEMING and the conclusions drawn from their observations. He himself made experiments in order to ascertain: — the influence which the age of the cow at the time of bulling and the season during which bulling took place might have on the duration of gesta-

ion: the relationship which exists between the sex of the calf and the duration of gestation, and the influence which the age of the cow may have on the latter. These observations, made on 369 gestations, led the writer to conclude:— 1) that the average period of gestation in dairy cows is 280 days — 2) that this duration is not variable according to breed; 3) that the sex of the calf does not appear to have any influence on the duration of gestation — 4) that the proportion of male and female calves was about equal — 5) that on the average 82.6 % of the calves remain from 271 to 290 days in the uterus — 6) that the age of the cows at the time of bulling was without influence on the duration of gestation — 7) that gestation was not influenced by the season in which bulling took place.

2) *Weight of calves at birth.* — The writer relates the work done on this subject by HEVARY & MORRISON and ECKLES. According to the researches which he made personally on the subject:— 1) of the influence which the age of the cow at the time of bulling might have on the weight of the calf at birth — 2) of the relation between the weight of the cow at the time of bulling and that of the calf at birth — 3) of the influence of the season during which bulling took place on the weight of the newly born calf — 4) of the influence of the duration of gestation on the weight of the calf — the writer concluded:— 1) that the average weight of calves at birth was 32.65 kg for males, 29.47 kg for females and 31.29 kg for all the calves — 2) that among pedigree calves, the heaviest were Holsteins, next Ayrshires, Guernseys and Jerseys — 3) that on the average, at birth the weight of calves of no special breed is the lowest, that of pure bred calves is the highest and that of half-bred calves very nearly the same as that of pure-bred calves — 4) that the average weight of newly born calves increases with the age of the cows, until the cows reach the age of 5 years, after which the weight of the calves decreases in an irregular manner — 5) that increase in the weight of the cows denotes an increased weight of the calves; this increase however is not directly proportional to that of the cow — 6) that possibly calves born between the months of April and October may be lighter than those born during the rest of the year; there are however considerable variations in the weights of calves born in the two periods — 7) that the duration of gestation has little influence on the weight of the calf; on the other hand, the nearer the duration of gestation is to the normal, the nearer the weight of the calf is to the normal weight, while their weight at birth increases when the duration of gestation deviates from the normal.

(3) *Rate of growth of dairy heifers.* — After referring to the researches of ECKLES, WATERS, MAC CANDLISH and ROBERTSON, the writer describes the method which he adopted in his researches on this subject. From his experiments he draws the following conclusions:— 1) Apparently there are few cases of loss of weight after calving — 2) The live weight of the animals increases most rapidly — 3) According to body measurements, it appears that the dimensions of breadth, depth, and height follow one another in the order of the rate at which they increase — 4) There seems to

be little difference between calves born in winter (that is to say between the 1st October and the 31st March) and those born in summer (from the 1st April to the 30th September), except that the heifers born in winter attain, at the time when bulling commences, higher weights and bodily proportions than those born in summer — (5) There seems to be a sufficiently distinct relation between the live weight (expressed in kg) of the animals and the product of their heights, depths and breadths (expressed in cm.).

D. S.

1078 — **Some Results of Reeding Milch Cows at Experiment Stations in the United States.** — WINTHERS, S. R., in *Heard's Dairyman*, Vol. LXIII, No. 12, p. 419, figs. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

Fort Atkinson, Wis., April 7, 1922.

Dairy cattle feeding experiments are being conducted at the 5 Stations of the Dairy Division, United States Department of Agriculture with the threefold object 1) to ascertain the productive capacity of cows and their ability to maintain weight when their ration is deprived of grain; 2) to ascertain the profitableness of feeding grain to milch cows; 3) to study the production of milk, butter, etc.

The author mentions results already obtained on these points: A Holstein (Helen Nilkje Calamity) made a creditable record, although from the age of about 8 years she was given no grain, her ration consisting of roughage alone. On lucerne hay, maize silage and pasture grass this animal yielded 470 pounds of butterfat in one year. The following twelve months, the same ration supplemented with a liberal ration of grain was fed to the cow with the result that the milk and fat production were respectively 25 499 and 823 pounds.

As regards the economical results of feeding roughage exclusively, varying conditions have to be taken into account. In dairy districts where the product is sold on a butterfat basis, the increased production due to the addition of grain to the ration might not yield much return; on the other hand, where the produce is marketed in the form of milk, the investment in grain might be very profitable. The author gives other instances of good records of Government cows kept at the above-mentioned Stations of the Dairy Division.

E. F.

1079 — **Comparison of early, medium and late maturing Varieties of Silage Maize for Milk Production.** — WHITE, G. C., CHAPMAN, L. M., SLATE, W. L., and BROWN, B. A., in *Journal of Dairy Science*, Vol. IV, No. 4, pp. 333-347, fig. 1. Baltimore, July 1922.

The experiment made by the authors is an attempt to determine the relative economy of milk production by growing early, medium or late varieties of maize for silage.

The varieties used to represent the 3 types were early, Pride of the North, Medium, Leaming; late, Eureka. The researches were carried out at the Storrs Agricultural Experiment Station (Connecticut, United States) upon Holstein, Jersey and Guernsey cows of ages varying from 2½ years to 10 years and 10 months.

It was found that late-maturing varieties, under favourable conditions.

[1077-1079]

are decidedly superior in yield to the early varieties, both as regards total tonnage and dry matter. The following five years averages were obtained for green maize: early group, cut at hard dough stage, 24 774 lb. per acre, water content 73.80 % — medium group, soft dough stage, 32 947 lb. per acre, water 78.09 % — late group, kernels just forming, 40 648 lb., water 80.16 %.

Pride of the North contained 25.74 % dry matter in silage; Leaming 25.17 % and Eureka 19.43 %. It must however be remembered that the season allowed Leaming to mature more than usual, so that the crop used in the feeding tests had practically the same percentage of dry matter as Pride of the North and gave very similar results.

The cows were fed silage as well as hay and a grain ration, the latter consisting of maize + wheat bran and cotton seed meal (3:3:2) having a nutritive ratio of 1 to 3.8 and carrying 14.8 % digestible protein and 11.71 % digestible nutrients. The hay consumed was 4 lb. per head and per day.

The feeding trial proper lasted 100 days, after a preliminary feeding first upon regular herd silage, and later on the experimental silage.

The amount of silage consumed per day by each group was as follows: 1st group (early maize) 44.977 lb — 2nd group (medium) 45.739 lb. — 3rd group (late) 45.537 lb. The amount of dry matter furnished by the silage per day to each group was respectively 11.232 lb. — 11.519 lb. — 9.081 lb.

The grain was fed in proportion to the weight of the animals, the object being to keep them at a uniform weight. By this plan, most of the food was used for maintenance and production, a very small amount contributing to the development of the foetus in early gestation. The average daily consumption of grain was 9.972 lb. by the early group — 8.314 lb. by the medium and 11.604 lb. by the late.

The following Table gives a summary of some of the most important data.

	1st group	2nd group	3rd group
Average daily milk yield. lb.	28.286	22.938	29.206
" " fat " lb.	1.0878	1.0455	1.0788
Total daily solid yield. lb.	3.5769	3.1578	3.5990
Average initial weight. lb.	1054.4	963.3	1046.8
Average increase (+) or loss (—) in live weight in 100 days lb.	+17.64	+22.33	-14
Grain consumption per 100 lb. milk (1) lb.	35.405	35.816	39.780
Grain consumption per 1 lb. solids in milk. . . lb.	2.752(2)	2.593	3.249

(1) The relatively high grain requirement per unit of production for all the groups is due to the small hay allowance.

(2) The better record made by group 2 in solids production is due to its lesser maintenance requirements.

The results thus show a saving for 100 pounds of milk of 4.37 pounds of grain for the group fed early maize as compared with the group given late maize. Ton for ton these data seem to indicate the greater economy of the early silage. This is further emphasised by the fact that the group given early maize gained a little in weight, whereas the group fed late maize lost slightly in weight.

F. D.

1080 - Quantity of Feed consumed by a Heifer from time of Birth to Lactation Period. — See No. 1095 of this Review.

GOATS

1081 - The Goat as an Economic Factor. — CRÉPIN, J., in *Le Lait*, Year II, No. 5, pp. 313-320. Lyons, May 1922 (1).

Goats are divided into three main fundamental racial branches. The most important has its original home on the great central plateau of Asia; next comes the group of African races which has its habitat in the Abyssinian Mountains; lastly the European branch has its origin in the great block of the Alps. Long hair and a light iris are characteristic of Asiatic origin; very short, silky and glossy hair on a coat of bright, vivid colour, and dark flashing eyes, indicate African origin. The goat in Europe has undergone such deep racial changes that its ethnic characteristic is no longer of serious interest for most breeders. However, in the mass of the Saint Gothard, a goat has been discovered which may be regarded as exemplifying the morphological unit of its species in the required degree. It appears in many varieties of coat, but has in all cases precisely the same economic value. It bears the stamp of a group of races which is necessarily that of the European goat, and of the typical European race. This breed is the largest and the coat is short haired and habitually of many colours, white being only found in cases of albinism. The coats of the Alpine goat are characterised by dull tints, generally shading off from black to tawny and from tawny to light through all shades of grey. The spots are marked in streaks on a ground which, at the extremities of the body, on the belly and the limbs is lighter in colour or is accentuated by a darker shade. A dark stripe often covers the whole length of the spine. The forehead of the Alpine goat has, in profile, a frontal boss. There is, also, near the muzzle, a small swelling indicating a good feeder. According to the writer, it is a mistake to think that there is one goat of the plains and another of the mountains. However, as regards pasture, it does well only in high regions. The most surprising fact in the biology of the goat is that this animal, which seems naturally intended to live in a wild and primitive state of life is admirably adapted to a diet absolutely different from that what appears to be its natural diet. Thus when abundantly fed it gives double the amount of milk which it would give normally.

Under the influence of good training, the lactation of the alpine goat can be prolonged over two years without interruption. The fact is all the more remarkable that an animal capable of supplying 6-7 and even 8 litres of milk per day at the height of its lactation draws this consider

(1) See: R. 1913, No. 1062; 1916, No. 205; 1918, No. 794; 1921, No. 33. (E4)

able mass of milk from a reserve of live substance the weight of which barely exceeds 60 kg. with 6 to 7 kg. of blood. The writer adds that this animal, which reaches maturity only at 4 to 5 years of age, is able to produce young from the age of one year and remains fertile till over the age of 20 years. It is even economically advantageous to profit by its precocity, for if made to produce when very young, its milking power increases and its appetite increases to enable it to meet the double physical expenditure, viz., that required for production and that for growth. The writer does not attach any value or economic importance to the horns, or to the colour of the coat for which the Swiss pseudo-races are recommended. He also notes that it is now possible, by simple measures of cleanliness etc. completely to conceal the peculiar flavour of goat's milk. If therefore goat's milk is no longer distinguishable in taste from best cow's milk and if also malodorous he-goats need no longer be kept in the herds, the writer no longer sees that there can be any reason to object to the use of hairy goats in the food services. In this connection the diffusion of an improved race of goats may be a matter of high importance. Its use on a large scale would greatly improve the diet of children and invalids and would provide a powerful element of control of tuberculous infection. Without claiming that the goat has in itself a concrete principle which immunises it against the microbe, it is possible to assert that the goat never contracts tuberculosis spontaneously. There is a pseudo-tuberculosis which attacks goats exposed to damp cold, but the milk cannot exercise its physiological properties in the organism of the newly born or invalids unless it is administered raw and in its integral form and properties.

The goat is the only animal which can supply children and sick persons with milk in this ideal form. The writer recommends the diffusion of the only European goat, which appears to be not only the authentic thoroughbred of the European race, but also the heaviest milker of the species. It is this race which should be improved by selection and have its excellent qualities established.

F. S.

082 - The Pasturing of Pigs. — DIFFLOTH, P., in *La vie agricole et rurale*, 11th year, Vol. XXI, No. 29, pp. 57-61. Paris, July 22, 1922 (1).

PIGS

The pasturing of pigs is a practical and advantageous method, which in certain countries, gives extremely valuable results. Pigs however owing to the nature of their digestive organs make a poor use of cellulose but economic considerations permit a reconciliation between theory and practice. With a system of pasture for well kept pigs, and a judicious use of supplementary green crops there is very little need of dry foods, or months at a time and the result is a valuable economy. In spring and at the beginning of summer pigs get a supplement of dry foods. In autumn also, when the sows litter and until the young pigs are weaned,

(1) See: R. 1912, No. 374 — R. 1914, No. 1153 — R. 1915, No. 942 — R. 1916, No. 880, 1104 — R. 1917, No. 836 — R. 1921, Nos. 1033, 1260 — R. 1922, Nos. 193, 460, 617. (Ed.)

a little grain is indispensable for the ration. The Americans adopt as a practical rule the giving about $1\frac{3}{4}$ litres of grain per sow each day as a supplement. At every other period, the pastures suffice and assure the best profit. Grain, if obtained economically, will always be valuable, as also cotton and ground nut cakes.

The pasturing of pigs is specially indicated in regions which contain large areas of clearings and of unenclosed woods. In America wooded lands are beginning to be used largely for maintaining pigs in spring and at the beginning of summer, when pasture crops are scarce. The groundnut then supplies the change required for completing the fattening of the animals. This method costs little for the production of a pound of meat, but with the rapid increase in the production of pigs, breeders have had to examine more closely the phases of this method of rearing and to make various pastures utilisable in all months of the year. The result has been the establishment of several systems of crop rotation. The principal profitable forage crops grazed by pigs are:—

1) *Oats and rye*. — Both are much appreciated as green forage in every farm rearing pigs. Some breeders sow a large stretch of oats, letting the whole be grazed up to the 1st March, then one part is enclosed to be grazed up to June while the remainder is left to ripen. This plan is to be recommended, as it assures pasture at a season when economical food is scarce. Moreover it allows the regulation of the portion reserved for grain according to the actual resources of the farm. Needless to say, the plot which is intended to furnish grain should not be "too closely" grazed if it is desired to avoid a serious falling off in the grain crop. Certain winter oats grow again vigorously after having been grazed and stand pasture well.

2) *Turnips*. — It is especially from January to May that turnips are a valuable resource; earlier or later, other food resources in full yield become available. Two judicious sowings of turnips will cover the difficult period.

3) *Millet*. — Its qualities are much appreciated, and it has the great advantage of providing food at the beginning of spring, at a time when cheap feeding is difficult to find. Sown early, in March, it may be grazed towards the middle of April. It is well to graze the plant early to make it tiller. Millet is a quick growing plant, capable of feeding many pigs for each unit of area. When young this forage is liked by the pigs; but it should not be allowed to become woody. If grazed up to the last, millet will be available up to the middle of July. With three sowings arranged in series in March, April and May, the period of grazing can easily last up to September.

4) *Sorghum*. — Is often sown in alternate rows, sometimes with millet. Sorghum stands grazing worse than millet and if browsed down to the ground, it suffers much. Even thus the young millet as being more tender is preferred and sought out by the animals, which gives the sorghum time to grow and reach a height at which its consumption is profitable and its resistance more assured. These two plants therefore sup-

plement each other and give variety to the feeding. Sorghum can also be used as a green food.

5) *Early Maize*. — Planted in spring it may be grazed or cut about the middle of July. Some breeders grow it alone, others in alternate rows with ground nuts. When the maize is cut green the pigs on pasture will eat the ground nut on the spot and this method gives an earlier fattening food. If it is desired to have at disposal a useful food as early as possible, early varieties of maize are sown, with early horse beans broadcasted between the rows of maize. On heavy soils the horsebean may be replaced by the dwarf kidney bean.

6) *Ground nut*. — Ground nuts fatten pigs at very small cost. Two varieties are grown for pigs:— the North Carolina, or African ground nut, sometimes called the Georgia groundnut, and the Spanish groundnut. The former is a large cropping variety. Planted early in spring, it begins to produce in the middle of September and gives an abundance of good food up to January and even March. It will fatten, without supplement, 7 to 10 pigs per ha. Planted early, the Spanish groundnut is ready for pasture in August, 6 weeks earlier than the Carolina variety, at a time when "finishing" food is scarce. Its yield is much less, according to certain growers. Although groundnuts supply a rapid fattening and pigs make remarkable increases in weight, they should not be fed exclusively with them for a period of more than 60 to 90 days; otherwise digestive disturbance would be caused. Sows with young should only be allowed to feed among the groundnuts with caution.

F. S.

1083 — **Distribution of Enzymes in the Alimentary Canal of the Chicken.** — FLIMMER, R. H. A. and ROSEDALE, J. L. (Biochemical Department, Rowett Research Institute for Animal Nutrition, University of Aberdeen and North of Scotland College of Agriculture), in *The Biochemical Journal*, Vol. XVI, No. 1, pp. 23-26. London, 1922.

POULTRY
BEARING

Lactase has so far never been found in the intestine of chickens. The authors fed chickens from hatching for a period of over three months with a ration containing lactose and noted its assimilation. Assimilation of disaccharides is usually preceded by hydrolysis to monosaccharides, and as this would imply the presence of lactase, the authors made an examination of the different parts of the digestive system to discover where the lactase was to be found. Their experiments confirmed the fact that it is absent from the intestine but a small amount was detected in the pancreas, the crop and the gizzard. They then extended their investigations to 8 other enzymes specifically concerned in the digestion of the common foodstuffs and obtained the following results:

The distribution of the suroclastic enzymes corresponds for the most part with that in the animal, diastase and lipase are generally present in the pancreas of animals; on the other hand there are differences in the distribution of the proteoclastic enzymes; the animal has trypsin acting in alkaline media, the chicken in both alkaline and acid media. The enzyme of the proventriculus, which in the chicken corresponds with the stomach of an animal acts only in acid medium.

{1082-1083}

	Crop	Proventriculus	Pancreas	Intestine whole	Duodenum	Illum	Cecum
Invertase	o	o	.....	+	.....	.....	o
Diastase	+	o	+	+	.....	.....	o
Lactase	+	o	.....	o	.....	.....	o
Lipase . . . . .	.....	.....	+	.....	.....	.....	o
Proteoclastic { neutral	o	o	+(slight)	o	o	o	o
enzymes { acid . .	+(rare)	+	+(less rapid)	+	+	+	o
in media { alkaline	o	o	+(rapid)	+(rare)	+	+(rare)	o

E. F.

BEE KEEPING

1084 - **Insulating Capacity of Double-Walled Bee-Hives.** — PHILLIPS, E. F., in *United States Department of Agriculture, Department Circular 222*, 10 pp. Washington, May 1922.

The great number of double-walled bee-hives on the market, where they find ready purchasers among bee-keepers by whom they are largely used, has given rise to considerable discussion as to their comparative merits. In order to decide the question, the author carried out a series of experiments and obtained the following information:

The shape of the hive has a considerable influence upon its insulating power, and therefore upon its capacity for preventing loss of heat and protecting the bees from winter cold. The heat escapes most readily from the bottom and the insulation of the walls and top is never so complete as to prevent a large amount of heat from being dissipated.

Bee-keepers however never trouble about the insulation of the bottom of the hive, as they are under the impression that the heat escapes through the top. It is a mistake to uncover the front of the hive, even if it faces south, for if any part of the hive is left with only a single wall, or without some other means of protection, all the efforts made to keep the rest of the hive warm are to a great extent nullified.

In the double-walled hives on the market the heat escapes so readily from the bottom, that little is lost through the roof and still less through the walls.

An air-space left between the two walls does not retain the heat as well as a layer of some material that is a bad conductor, especially if the interstices are very small. Convection currents which dissipate the heat are doubtless always present in the dead angles of the cavity of the hive. The board forming the ceiling should extend as far as the external wall upon which the roof rests. It is more effective to close the double wall only, than merely to shut the opening of the hive.

A thicker layer of insulating material should be used than is generally the case. If sawdust is used, the layer ought to be 10 to 15 cm. thick.

F. D.

1085 - "La Loque" (*Bacillus alvei*) a Bee Disease. — CHEVILLOTTE-MEVEL, O., in *L'Apiculteur*, Year LXXI, No. 8, pp. 270-272. Paris, Aug. 1922.

This disease is caused by a special bacillus (*Bacillus alvei*), a distinct species, according to the writer, but capable of assuming different forms dependent upon its degree of virulence and the nature of environment in which it develops. The therapeutic treatment may also be preventive, and consists in the use of antiseptics (salicylic acid, mixture of carbolic acid and tar, formaldehyde, naphthol β , etc.). The writer was only able to get incomplete results by using antiseptic syrups, which have no effect on larvae already infected.

The best and most scientific prophylactic method is permanently to disinfect the hive with formic acid or 10 % solution of formol; to do this, paraffin wax should be smeared on the insides of several tin boxes (the lids of blacking boxes may be used) to a depth of 1 to 1.5 cm. and they should be filled with the following mixture:—Formic acid or commercial formaldehyde, 2 parts — Alcohol, 1 part — Water, 6 parts. These tins are placed in the hive and the mixture is renewed every week. Generally 3 or 4 doses are enough; sometimes, however, it is necessary to prolong the treatment.

H. F.

1086 - Sericulture in Libya. — FORLANI, K., in *Bollettino della R. Stazione Sperimentale di Gelsicoltura e Bachioltura di Ascoli Piceno*, Year 1, No. 1, pp. 23-30. Ascoli Piceno 1922.

SILKWORM
REARING

Breeding of the domestic silk worm was started at Bengasi in 1915 and gave fairly good results. On the initiative of Prof. DE CILLIS (Director of the Agricultural Bureau of the Government of Tripolitania) the breeding of other silk producing insects (which might find in Libya the conditions of environment necessary to their existence) was tried successively, these being:—*Philosomia arrindica* (which lives on the castor oil plant), *Attacus bombinia* of the Sudan (which can live on *Ziziphus*), *Attacus cynthia* (which lives on the *Ailanthus*) and *Attacus cecropia*; but the results were negative.

Breeding of domestic silkworms continues to increase as shown by the following Table:—

Years	Kg. of fresh cocoons	Kg. of dry cocoons	Unit of price	Gross yield
1916	400	135	18	2 430
1917	1 200	460	30	12 000

The propagation of the mulberry tree is under Government control: 2671 plants were distributed in 1916 and 9743 in 1917. In spite of various ailments, which sometimes rage in the broods, it is not uncommon to find in properly built premises productions of 75 kg. of fresh cocoons per ounce of eggs.

According to DE CILLIS (1), MAZZOCCHI-ALEMANNI and LEONE,

(1) DE CILLIS, E., Cinque anni di sperimentazioni agrarie in Tripolitania, *Agricolt. Colon.*, XV, No. 6. (Author's note)

the second fortnight in March is in Libya normally the most suitable time to start breeding, and the premises which are most suitable for native breeding seem to be silkworm nursery huts, partly underground, with walls above ground. For the methods of breeding, suspended sieves made of local material such as reed grass, palm leaves etc. have proved suitable; for wood, the wild flora are very suitable:— *Brassica fourmeorti* (in arabic "hassluss"), *Pituranthus tortuosus* ("gazzali"), *Raetam raelam* ("rtam"), *Euphorbia guyoniana* ("lebbin"), mid-ribs of the leaves of the date palm, etc. Pure breeds have shown themselves the more likely to give a high quality yield, but are much less resistant to surrounding adverse circumstances, it is thought therefore that the Chinese bi-yellow and multi-yellow crosses are the most suitable breeds.

The silk market of Tripoli at any rate up to a few years ago was almost exclusively supplied with Chinese silk, because owing to the primitive systems of spinning in use the thread of the local cocoons was much weaker than the thread of the Chinese cocoons. The Italian standard most commonly used is 8/100.

Chinese silk coming from Shanghai is classed as follows in the Tripoli market:—

White Steins, blue Phoenix extra.
Yellow ST, n° 1 yellow Mayung.
Yellow ST, n° 2. " "

The silk most in request for making burnous is the yellow silk ST No. 1

The silk-producing industry is domestic and it is ordinarily carried on by the Jewish population (1). E. F.

1087 - Value of Maintaining an even Temperature during the Incubation of Silkworms' Eggs. — ACQUA, C., in *Bollettino della R. Stazione sperimentale di Gelicoltura e Bachicoltura di Ascoli Piceno*, Year 1, No. 1, pp. 13-23. Ascoli Piceno, March 1, 1922.

A constant temperature or a slight and gradual rise is recommended for the incubation of silk worms' eggs, and accidental sudden thermometrical changes are considered as very injurious to breeding results: GRANDORI (2) also considers a constant temperature essential, especially during early stages of fertile development. On the other hand, VERNON reports that eggs electrified as soon as they are laid (to cause out of season hatching) may be subjected without injury to temperatures little above 0° and may remain at that temperature for several weeks, and MARTINI has obtained the normal development of eggs treated with hyd.

(1) Information regarding the treatments to which silk thread is subjected in Libya before being distributed to the trade, is contained in an Article entitled "Il Commercio e la lavorazione della seta", published by the *Bollettino d'Informazioni del Ministero delle Colonie* (1921). (Author's notes.)

(2) GRANDORI, M., I problemi vitali della bachicoltura nel momento attuale. Trent, 1921. (Author's note)

rochloric acid and then kept during the summer for several weeks in a refrigerator. The matter is therefore up to the present, a subject of controversy which the writer has tried to settle by proposing to answer the two following questions:— 1) Does a sudden chill during incubation necessarily cause a state of deterioration which may be seen in a higher percentage of unhatched eggs and by irregular progress in breeding? (2) Does this sudden chill produce different results according as it affects different periods of incubation.

Experiments have been made on the following breeds:— indigenous yellow, gold Chinese, white Chinese, Chinese cross ♀ white × ♂ yellow), Chinese cross (♀ yellow × ♂ white), double-strain yellow cross (♀ yellow × ♀ gold), double strain yellow cross (♀ gold × ♂ yellow). In all the cases severe chilling, even when prolonged for several hours (12-24), during incubation, did not produce the disastrous effects which would generally have been expected: there was only a slight increase in the percentage of unhatched eggs and a prolongation of the hatching period, but no injury was caused to the breeding and no decrease of yield as was proved by the average weight of the cocoons of the different lots which were used in the experiments. In reality, there was no contrast, as was only to be expected, between the behaviour of the egg treated for out of season hatching (which is not affected by retardation through chilling) and the behaviour of the egg normally hatched in spring.

It also happens that incubations of indigenous yellow eggs, treated with hydrochloric acid and intended for summer breeding, made at a constant temperature, showed no difference from those exposed to varieties of temperature by day and night, either in the progress of breeding or in the percentage of mortality. During incubation, there was no critical period at which particularly harmful consequences might be caused by a sudden chill; in the different lots of the experiment, the change in temperature was made at very various times and it had, *for all equally*, the same small differences relatively to the control lots. If there had been a critical period, it must have clearly shown its effect by a high percentage of eggs unhatched in the lots which underwent a change on a particular day.

It is easy to see the practical lesson to be derived from these experiments: if an accidental temporary fall in temperature takes place during incubation, the heat in the incubation rooms should not be increased suddenly but gradually.

E. F.

188 - **Forced Hatching of Silkworms' Eggs with shortened Hibernation.** — I. ACQUA, C., in *Bollettino della R. Stazione Sperimentale di Griscicoltura e Bachicoltura d' Ascoli Piceno*, Year 1, No. 1, pp. 3-9. Ascoli Piceno, March 1, 1922. — II. IDEM, Schiusura estemporanea del seme bachi a ibernazione abbreviata ed esame della pebrina, *Ibidem*, Year 1, No. 2, pp. 45-48. Ascoli Piceno, June 1, 1922.

The writer has made the two following series of experiments:—

1) On November 21, 1921, he treated with strong hydrochloric acid, for 20 minutes, two lots of silkworm eggs one of the native yellow race the other of double-strain yellow (♂ yellow × ♀ gold) which had up to that

time never been subjected to temperatures below 15°. After thorough washing, the lots treated were placed in a refrigerator at 4°-5° in which they remained for 45 days; they were taken out on January 5, 1922 and subjected to a forced incubation up to 26°. On January 17, the first hatchings began; they lasted 6 days and gave the following results for 300 eggs taken at random from the whole of the treated lot and of the control lot:—

	Native yellow	bi-yellow
Treated eggs.	Hatchings 287	Hatchings 257
Untreated eggs	" 7	" 82

These results shew that *the treatment with hydrochloric acid does not cause hatching of old eggs, but predisposes them sufficiently to secure hatching by the help of the subsequent action of cold limited to half the normal time.*

(2) In the second series of experiments, the writer reversed the two stages of the process: a total of 20 samples of native yellow eggs was placed in the refrigerator for 33 days (from November 15 to January 17), then the treatment with hydrochloric acid described above was given and the incubation started. Hatchings took place at the end of January; they were complete and very numerous in the treated lots, but very few in the controls. Therefore, *the treatment with hydrochloric acid is as effective before as after hibernation.*

The results indicated by the sentences in italics have great practical importance: it is known in fact that at present, owing to the application of the law regarding the control of silk-worm eggs, they must be subjected to microscopic examination, to insure their being free from pebrine. Technical necessities require that this examination should be made just before hatching; it follows that adding to the period preceding the normal hibernation, the period necessary for examination and for a second contingent examination, a very advanced stage is reached. The material impossibility of carrying out the examination in good time is eliminated by the method adopted by the writer, which reduces to less than half the period of hibernation required and, consequently, gives a practical solution of the problem.

It might be thought that this method hinders the development of the pebrine germs which may be contained in the eggs treated, but this risk is excluded by the researches of the writer, of which he gives an account in the second of the Articles reviewed. In the moths belonging to two sets in series 1) a slight infection of pebrine showed itself; it was thought therefore that the eggs also were partly infected; in fact the examination of the young caterpillars hatched under special treatment contained a slight percentage of infected individuals.

A second and more rigorous test was undertaken by means of two

other series of experiments made one at the beginning and the other at the end of March 1922. The lots in the first series were treated with hydrochloric acid for 15 or 20 minutes, then with electricity for 5 minutes: it was ascertained on the whole that the percentage of cases of infection with pebrine was slightly decreased by the action of the acid. On the other hand the electric treatment caused no differences in the control lots. The lots of the second series, treated with hydrochloric acid only, differed in no way from the control lots; the writer therefore thinks that the difference in the first case was fortuitous and that it is permissible to conclude that the treatment with acid does not check the development of pebrine in infected eggs.

F. F.

1089 - **On the Relation of Pebrine Infections in Bombyx Moths and in the Eggs at rest and just before Germination (Expediency and Desirability of Testing a modified Method of preparing Silkworm-Eggs).** — LOMBARDI, I., in *Bollettino della R. Stazione Sperimentale di Gelsicoltura e Bachioltura di Ascoli Piceno*, Year 1, No. 2, pp. 48-57. Ascoli Piceno, July 1, 1922.

Ordinarily eggs of the silkworm at rest do not show clearly the pebrine corpuscles but in the case of intense infection some corpuscular eggs are sometimes found even in the state of rest. The writer has examined with the greatest care numerous sets of eggs coming from infected moths and has attempted to establish a certain relation between the degree of infection at the state of rest and that ascertained just before hatching. The work was supplemented by the examination of the moths, which was done in the following manner:— 500 cells, 56 of which contained infected moths, were taken out of a group of yellows which had a considerable percentage of infection (10 %). The test was made by crushing in a mortar one wing with 3 drops of water; a drop of this mixture taken up on a rod was placed between two sheets of glass; the corpuscles found in each space were then counted and the examination of a certain number of spaces gave the average; in the case of certain individuals the corpuscles were too numerous to count and others (where counting was possible) formed a series from 260 to 0.5.

After the examination of the moths, the writer examined the eggs at rest, by crushing for the purpose each egg in a drop of water. After complete hibernation these sets of eggs, were separated and placed to incubate and later just before germination each egg was again examined. The writer examined 100 eggs at rest and 150-200 just before hatching.

A lot of Chinese gold eggs in which infection was less intense were examined: out of 500 sets of eggs, only 39 were infected and there were, as a maximum, 19 corpuscles per space.

The writer gives, in tabular form, the results of these examinations, and draws from them the interesting conclusion that not only the slightly infected moths but also those heavily infected, can furnish sound eggs. In microscopic selection, such as is made by breeders, a certain quantity of sound eggs are therefore rejected, but this must be considered for the present as a necessity of the general method of examination, which it is impossible to change.

The comparisons made between the degree of infection of the eggs at rest and that of the eggs when about to hatch have given results which do not enable any relation to be established between what the microscope reveals in the examination of eggs at rest and in that made at the moment when the eggs are about to hatch. It is not therefore possible to calculate the approximate percentage of actual infection by means of the number of infected eggs found in the former case.

Lastly the writer suggests that in the preparation of the summer eggs and in cases where it is desired to delay hatching by placing the cells in a refrigerator, only cut wings should be included; this method does not in any way prevent the examination for pebrine, since when infection is found in the body of the moth it is always present in the wings; moreover it offers very marked practical advantages, such as the elimination of the putrefiable bodies of the moths and protection against *Dermestes* which often devour both moths and eggs.

E. F.

1090 — Duration of Virulence of the pathogenic Agent of Jaundice in the Silkworm. —

ACQUA, C. in *Bollettino della R. Stazione Sperimentale di Gelsicoltura e Bachi-coltura di Ascoli Piceno*, Year 1, No. 1, pp. 10-12. Ascoli Piceno, March 1, 1922.

It is known that the hemolymph of the silk-worm attacked by jaundice shows very numerous polyhedric granules (probably degenerative products), which are very effective in the propagation of the disease on account of their intimate connection with the pathogenic virus. Now as the diseased silkworms when the skin is broken give out blood which is very rich in granules and may contaminate the sieves on which breeding takes place, it is expedient to find out whether the disease can be thus transmitted from one year to another, if there has been no systematic disinfection. The writer has therefore undertaken experiments to determine how long the polyhedric granules can preserve their virulence: in 1920, he obtained an experimental development of jaundice by means of granules collected in the spring of the previous year and preserved without any special precautions; in 1921, the results were positive for other granules collected in 1920 and negative for those of 1919. It is therefore clear that infection is easily transmissible from year to year, by means of sieves or other contaminated material, while in the second year virulence appears to be extinct. In any case, rigorous disinfection is absolutely necessary in the districts where jaundice is particularly virulent as for example Campania.

E. F.

FISH
BREEDING

1091 — Pisciculture in Switzerland in 1921 (1). — Rapport du Département fédéral de l'Intérieur, in *Bulletin suisse de Pêche et de Pisciculture*, year 23, No. 7, pp. 103-107. Neuchâtel, July 1922.

CONFERENCES. — For the first time since 1914, a meeting of the Commissioners of fisheries in Lake Constance, nominated by the adjacent States, took place on September 23 1921 at Friedrichshafen. Among the subjects discussed may be mentioned:— the application of the regulation defining a certain width for the mesh of the bag of the drag net —

(1) See R. Nov. 1921, No. 1152. (Ed.)

the adoption of uniform conditions for the duty on fishing permits for the upper lake — the supervision of fishing in the upper lake — the tax on motor boats — regulations relating to the collection of the fry of the feras, (*Coregonus fera*), etc.

Various questions relating to fishing in Lake Constance, the Lower lake and the Rhine were dealt with by correspondence between the representatives of the interested Governments.

The negotiations with France for the establishment of an agreement regarding fishing on Lake Lemán led to international conferences in the course of which a draft convention was completed. Others were initiated or an understanding regarding fishing in the Doubs.

Progress was also made with preliminary work on the revision of the Italian-Swiss Convention regarding fishing and regulations for its practical working during the year.

FISHING IN LAKE CONSTANCE. — According to the statistics of fishing in Lake Constance (including the Lower lake), Swiss professional fishermen took, in 1921, 175 244 kg. of fish, to a value of 351 439 fr.

SUPERVISION OF FISHING. — For payments to the staff engaged in supervision, the Cantons spent 210 402 fr.; 50 % of which was re-imbursed by the Confederation. For the destruction of animals injurious to fishing the Cantons spent 1251 fr.

A course for fishery guardians took place at Lucerne from the 25th February to the 3rd March.

CONTAMINATED WATER, FISH LADDERS AND SANCTUARIES. — In a certain number of cases the "Département Fédéral de l'Intérieur" intervened with the competent Cantonal authorities to prevent or rectify the pollution of water by factory refuse. The measures to be taken for the protection of fish at the time of construction of factories using water power or other hydraulic works have received special attention. Numerous schemes for the correction of river banks have been prepared. A Bado-Swiss international Commission, was charged with the drafting of rules to be followed in future to improve and utilize the waters of the Rhine between Bâle and Lake Constance.

PISCICULTURE. — During the hatching season of 1920-1921, 218 hatch-breeding establishments have been at work. The 176 036 000 eggs hatched produced 136 461 000 young fry including 314 058 summer fry and yearling fish turned out into public waters under official control. The young fry belonged to the following species (in thousands): — salmon (*Salmo salar*) 953 — hybrid salmon-trout 150 — lake trout (*Trutta cristata*) 2916 — brown trout (*Trutta fario*) 9985 — rainbow trout (*Salmo gairdneri*) 818 — American grayling (*Salmo fontinalis*) 14 — char (*Salvelinus*) 3323 — grayling (*Thymallus vulgaris*) 3360 — coregons 155 — pike (*Esox lucius*) 14 787.

The Confederation paid over to the Cantons, for division among the hatch-breeding establishments the sum of 49 060 fr. by way of contributions for rearing and turning out the fry.

Through its Fisheries Department the Government of the United States

made a gift of 50 000 fertilized eggs of the rainbow trout (*Salmo irideus* and of the salmon of the great lakes of North America (*Christivomer namaycush*) to the "Département suisse de l'Intérieur". These will be dealt with in the various fish breeding establishments and used for stocking certain rivers and lakes.

F. D.

**VARIOUS
ANIMALS**

1092 - **American Moles as Agricultural Pests and Fur Producers.** — SCHEFFER, T. H. (Assistant Biologist, Bureau of Biological Survey), in *United States Department of Agriculture, Farmers' Bulletin* 1247, pp. 3-23, figs. 16. Washington, March 1922.

There are in the United States 5 species of true moles: the common mole, *Scalopus aquaticus* found in the plains of the Eastern States — the star-nosed mole (*Condylura cristata*) and the Brewer mole (*Parascalops breweri*) common in the greater part of Pennsylvania, New York and New England, Michigan, Minnesota and to the north of these states — the Townsend mole (*Scapanus townsendii*) of the Pacific Coast States which is the largest of its kind and more abundant locally than any other species and the Gibbs mole (*Neurotrichus gibbsii*), another West coast form, but so rare as ordinarily to escape notice.

The author describes the external characters, specific and differential, of these species, their habits, development, food, natural enemies the damage they cause, means of control, the preparation and utilisation of mole skins. The bulletin is too long to allow more than a brief summary; the following are some of the most interesting and least known facts mentioned.

Contrary to the generally received opinion, the mole does not confine itself to regular periods of work each day (morning, noon and evening), but is equally active at any hour, especially at seasons when there is no great variation in temperature during the 24 hours. Moles are probably never dormant and do not hibernate; they however extend their surface runways at times when soil conditions are favourable, e.g., after rains in summer or during periods of thaw in winter.

Moles grow and develop with extraordinary rapidity.

They are however slow breeders, the number in a litter is commonly 3 in the case of the Townsend mole and 4 with the common eastern mole. The Townsend mole forages in gardens more than the ordinary species.

As regards the supposed natural enemies of the mole, hawks and owls take only a small toll. Poisoned mixtures are of little use, and traps are much more effective. Of these there are many simple types on the market. The trap should be set in runs made in moist rich soil, but no part should project into the cavity, or the moles will burrow beneath it.

Moles may be trapped successfully in the Pacific coast country at any season of the year, and elsewhere when the weather permits. If the trapping is for the purpose of obtaining fur, winter and midsummer are the most favourable seasons, as the pelts are then in the best condition. Care must be taken to use traps that do not tear or damage the skins.

The pelts are classified according to the appearance of the leather.

[1091-1092]

side; good class skins are of a clear tan colour, while inferior skins are spotted or blotched with bluish-black. Although mole-skins have long been articles of considerable commercial importance, all the pelts used by furriers in America up to about 1917 were obtained through importation from London, the prices paid annually being between 2 and 3 million dollars.

The Bureau of Biological Survey has recently stated that the skins of the common American mole (*Scalopus aquaticus*) are quite as good as the imported skins of *Talpa europaea* while those of the common large mole of Washington and Oregon are of superior quality. Since these facts have been recognised, a local trade in moleskins has arisen and about 50 000 dollars' worth of American pelts were marketed in 1918, and in 1919 the business increased by nearly 25 %.

E. F.

FARM ENGINEERING.

1093 - **Power Farming in Egypt.** — CASORIA, M., in *L'Egypte contemporaine*, Year XIII, No. 62, pp. 86-82. Cairo 1922.

AGRICULTURAL
MACHINERY

In agricultural practice in Egypt, power farming, although its great advantages are recognised, has not spread in proportion to the great extent of land which might be so cultivated; the reasons are as follows:—

- 1) The net cost is still too high.
- 2) The fact that machines are wanted only for certain work and the delay caused by repairs, owing to the lack of workshops in the districts.
- 3) The difficulty, in certain parts of Lower Egypt, of carrying out power farming owing to the close network of irrigation canals.
- 4) The lack of positive data regarding the net cost, deduced from a test of at least three months uninterrupted work.

The writer concludes that if the manufacturing firms agreed to carry out a definite test, with the approval and assistance of the Ministry of Agriculture, which would make clear the economic and industrial advantages of this mechanical system of cultivation with types of small, medium and large tractors, the result would be convincing, and Egyptian farmers, seeing these advantages, would replace the old methods of agriculture by the mechanical system.

G. D.

RURAL ECONOMY

1094 - **Receipts and Payments in the Cultivation of Ghessab in Sicily.** — See No. 1056 of this Review.

1095 - **The Feed Cost of a Heifer from Birth until the Beginning of the first Lactation Period.** — MC CANDELISH, A. C. (Iowa State College of Agriculture and Mechanical Arts, Ames), in *Journal of Dairy Science*, Vol. V, No. 4, pp. 348-361. Baltimore, July 1922.

Table I gives a summary of the author's previous work in determining the feeds required by dairy heifers grown to the producing age.

[1092-1095]

TABLE I.

	Authority		
	BENNETT and COOPER	HAYDEN	TRUFMAN
Months fed	24	26 1/2	24
Feeds:			
Whole milk, pounds	342	459	445
Skim milk, pounds	3165	3330	2952
Grain	547	1710	737
Dry roughage	2649	2634	3145
Silage and soiling	3603	4042	2938
Pasture, days	294	322	300

The animals used for these experiments which lasted for 5 years, were 40 in number and consisted of pure-bred and grade Holstein, Guernsey and Jersey heifers and pure-bred Ayrshires. Twenty-four of the heifers calved between October 1 and March 31 and were classed as winter heifers; the other 16 which calved between April 1 and September 30 came under the head of summer heifers. In each of these groups, the heifers calved at the average age of 29 "months", the month not being a calendar month, but a period of 30 days.

The average birth weights were 68 lb. for the winter heifers, 64 lb.

TABLE II. — Feeds consumed in 29 months (from birth).

		Cows calved in winter	Cows calved in summer	All the cows
Milk	days	3.5	3.5	3.5
Pure milk	kg.	690	599	652
Skim milk	"	956	991	969
Crushed Maize	"	724	673	701
Maize gluten feed	"	31	55	40
Crushed oats	"	140	118	129
Wheat bran	"	229	206	220
Linseed cake	"	140	118	129
Linseed cake (crushed).	"	15.4	16.3	15.9
Total of concentrated feeds.	"	1382	1299	1348
Total of ensilaged forage.	"	1855	2028	1924
Total of hay	"	129	158	141
Pasture	days	323	368	341
Lucerne hay	kg.	1623	1127	1425
Sugar cane forage	"	98	99	98.5
Maize forage	"	414	493	445

the summer heifers and 67 lb. for all the animals. The average weight at the beginning of the lactation period were 1010 lb., 941 lb., and 982 lb. for the winter, summer and both groups respectively. The average liv-

weight gains from birth to the beginning of lactation were 942 lb., 877 lb. and 915 lb.

The average daily live-weight gains throughout the trial were respectively 1.09 lb., 1.01 lb., and 1.05 lb.

The author reckons the feed prices per ton as follows: Crushed maize 10 dollars — hominy feed 20 dollars — Ground oats 15 dollars — wheat bran 20 dollars — linseed oil meal 32 dollars — cottonseed meal 32 dollars — lucerne hay 12 dollars — sugar-cane forage 8 dollars — maize forage 10 dollars — maize silage 4.50 dollars — soiling 4 dollars — whole milk per 100 lb. 2 dollars — skim milk per 100 lb. 0.25 dollars — sucking, per day 0.06 lb. — pasture per day 0.05.

In total feed cost of production, the ranking was: winter heifers, 109.89 dollars; summer heifers, 102.43 dollars, and all heifers, 106.81 dollars each.

The average feed cost per lb. of increase in live weight was 117 cents. in all groups.

F. D.

1096 - **Variations in the Cost and Sale Prices of Butter before the War, and from 1913 to 1921, in the United States.** — Ross, H. A. (Illinois College of Agriculture), in *Hoard's Dairyman*, Vol. LXIII, No. 6, pp. 192-193, Fort Atkinson, Wis., February 24, 1922.

The author has plotted curves for the cost price of the fat content of butter with the object of comparing the economic position of butter-producers between 1918 and 1921 with their condition before the War. For this purpose the average amounts of feeds required for the production of one pound of butter were multiplied by the price of these feeds for every month from September 1918 to October 1921. The cost price each month was compared with the price, for the corresponding month for the period 1909-1913. The results obtained were expressed in terms of the 1909-1913 average made up to 100; thus, if for instance the cost price was 200 for any given month, it is double what it was before the War.

If the chart giving these results is examined, it will be seen that from September 1918 to June 1920, the cost price continually increased, reaching during the greater part of this period, a figure double the pre-War average; from June 1920 however there was a rapid fall, which during the last months, brought the prices slightly below those obtaining before the War. This means that the same quantity of the same feeds has a lower value now than just before the War broke out.

The author made a similar chart of the sale prices of butter, comparing the average monthly price on the Chicago market with the quinquennial average of the corresponding months during the 1909-1913 period. This curve (from September 1918 to December 1920) tends to assume the same form as the preceding curve with slight variations in either direction. This result does not indicate that the cost price of the fat was nearly equal to that of the butter, but that the ratio of the cost and sale price was the same as before the War. Thus, if the cost price of the fat was 200, the price of butter was about double what it had been in pre-War days.

As stated above, there was a considerable fall in the cost price of fat between January 1921 and January 1922, whereas no proportional drop took place in the prices of butter. It is however true that the price of butter cannot be regarded as corresponding exactly to the price paid to the producer for the fat; the expenses of handling the butter account for some of the difference between the present and pre-War cost of butter.

Although the cost price varies in each case, the graphic index shows the relative position of each producer and proves that the dairyman who made a profit before the War now makes a higher profit, while any loss where it occurs, is less, which signifies that the present economic position of the butter producer is better than it was during the 1909-1913 period.

In short, given the present cost of fats and feeds, it is advisable for the dairy farmer to increase the cereal ration of his cows up to the point of obtaining a corresponding rise in the milk yield.

E. F.

AGRICULTURAL INDUSTRIES

INDUSTRIES
DEPENDENT
ON PLANT
PRODUCTS

1097 - Composition of Wines of Lees and Lees of Wine. — SEMICRON, L., in *Comptes rendus de l'Académie des Sciences*, Vol. 174, No. 18, pp. 1179-1182. Paris, May 1, 1922.

The comparison between the wine first drawn off (choice wine), the wine taken off the lees by decantation and the wine taken from the lees by pressing in bags has given respectively in analyses made by the writer: Alcohol % in volume: — 10.55 — 8.50 — 8.95; Total acidity as sulphuric acid 5.50 — 5.40 — 5.45 — Fixed acidity as sulphuric acid 5.10 — 5.0 — 4.90; Volatile acidity as sulphuric acid: 0.40 — 0.40 — 0.55%; Dry extract at 100°: 21.27 — 32.75 — 32.82; Total ash: 2.45 — 2.65 — 2.70; Soluble ash: 2.25 — 1.90 — 1.85; Alkalinity of the ash in bitartrate of potash, per litre: 5.07 — 1.62 — 1.67; Bitartrate of potash: 4.13 — 1.83 — 2.08; Total tartaric acid in bitartrate of potash, per litre: 5.05 — 2.39 — 2.45; Total potash in bitartrate of potash, per litre: 4.59 — 4.14 — 4.17; Sulphate of potassium: 0.31 — 0.34 — 0.35; Phosphoric acid: 0.175 — 0.471 — 0.455; Polarimetric deviation: 0 — 0 — 0; Total alcohol + acid: 16.08 — 13.90 — 14.40; Alcohol Ratio: extract 4.3 — 2.1 — 2.3. These analyses show that there are in the wines of lees compared with the wine drawn off:— 1) a decrease of about 2° in the alcoholic strength — 2) constancy in total acidities, fixed and volatile — 3) increase of dry extract of at least 50% — 4) slight increase of ash, with decrease of soluble ash and increase of insoluble ash — 5) considerable decrease of alkalinity in the ash, reaching 2/3 of the original amount — 6) decrease of 50% and more of bitartrate of potash and total tartaric acid, while the total potash scarcely decreases by 10% — 7) increase of phosphoric acid, the quantity of which is more than double — 8) very sensible decrease of the total alcohol + acid; increase of the acid ratio: alcohol; decrease of 50% in the alcohol: extract.

The bitartrate of potash lost was replaced by biphosphate of potash in pro-

portions corresponding to their molecular weights. — These characters, which are peculiar to wines of lees arise from the digestion process which takes several weeks and are due to old yeasts undergoing decomposition and which have been carried away in quantities with the wine at the time of racking and which are afterwards deposited and constitute the greater part of the lees. The fact that these yeasts are rich in phosphates, lime and magnesia, explains both the peculiar characters of the composition of wines of lees, and the origin of the tartrate of lime in the lees. During the period of rest in small receptacles and before decantation, the proportion of yeasts in process of decomposition is very great with regard to the volume of wine; a molecular exchange is made between alkaline-earth biphosphates which the yeasts diffuse in the wine and the bitartrate of potash which the latter contains. The bitartrate of lime which is formed is deposited and passes entirely into the lees, thus reducing the cream of tartar in the wine; the biphosphate of lime in the lees on the other hand is transformed into very soluble biphosphate of potash which is found again in the wine of lees after decantation or filtration.

The decrease of alcohol is due either to evaporation or to flowers of wine (*Mycoderma vini*). The increase of dry extract is due to the passing into the wine of nitrogenous substances which the dead cells have diffused in the wine.

PRACTICAL CONCLUSION. — It is preferable to pass the muddy lees, after the first drawing off, immediately through a filter press rather than to leave them for a long time to digest. Wine so extracted by the filter press would have an approximately similar composition to that of normal wine.

F. D.

98 — Should Apples for Cider Making be washed? — GIRARD-VATON, D., in *L'Alimentation moderne et les industries annexes*, new series, Year 19, No. 20, pp. 87-88 Paris, July 1922.

In Germany, Switzerland and in other countries, it is considered necessary to wash the apples before making cider. In France on the other hand that practice has partisans and opponents. The first remark is that generally the apples are covered with dust, mud, dejecta of insects, micro-organisms and refuse of all kinds as well as with a kind of perspiration which they undergo after the fruit is gathered. Even if they look clean, this syrupy perspiration forms a very good stratum for the development of numerous germs. The above-mentioned impurities are mixed with the pulp during crushing; they pass into the must and give the cider a disagreeable taste and smell. On the other hand, the view is held that washing removes the ferments which help fermentation, that it dilutes the must by the water which is added, and lastly that it takes away from the cider, part of the perfume coming from external matter.

The writer has made some researches with the object of determining the quantity and the nature of substances removed by washing. He has subjected several varieties of cider apples to washing, using 20 kg. of each variety. The matter removed by washing varied between 2.05 gm. and

[1087-1098]

26.85 gm., or the equivalent of 102.5 — 1342 gm per ton, that is to say entirely negligible quantities. The impurities removed formed an unpleasant mud which became even worse after calcination.

Analyses have given on the average the following results:—

Dry extract with "bain-marie"	7.358 %
Total sugar	4.630 %
Tannin	0.023 %
Pectic matter and aluminoid	1.412 %
Ash	0.704 %
Total acidity as malic acid	0.191 %

For a ton of apples, the loss of sugar which is the most important would be scarcely 281.5 gm. If washing is prolonged the quantity of matter removed increases; hence, the apples should not remain long in the water and excessive movement should be avoided. After washing it is recommended to dry the fruit. This may be done by means of machinery which should be found in all good cider factories.

L. V.

1099 - **The Olive Oil Industry in Greece.** — BOGRIS, D. (Inspector of Industry at the Ministry of National Economy), in *L'Economiste d'Athènes*, Year 2, No. 27, pp. 417-421, Athen., 1922.

The annual production of olive oil in Greece amounts on the average to about 73 million *okas* (1 *oka* = 1.250 kg.), not including that of Macedonia. As the home consumption is from 35 to 40 million *okas* and as New Greece has enough for its requirements and can export olive oil, there remains for export at least 22 million *okas*.

The Greek olive oils are often too acid and sometimes have a disagreeable taste. While in no European State it is permissible to sell a food oil of acidity above 5 degrees (total acidity as oleic acid), the oil retailed in Greece commonly have an acidity of from 15 to 20 degrees sometimes as much as 30 degrees; in the latter case they are injurious to health.

These drawbacks are due:— 1) to the deterioration of the oil owing to their late collection and bad storing; 2) to the imperfect mechanical plant of the oil factories; 3) to the want of cleanliness in the factories.

The writer suggests the adoption of legislative measures to enforce the adoption of scientific methods in the manufacture of the oil as done in France, and formulates a series of proposals concerning:— basis of valuation of the oils — measures in favour of the consumers — measures against uncleanness in the oil factories — measures for the time olive oils.

F. D.

- 1100 - **Manufacture of Tapioca Starch at Porto Rico.** — GORBEA, PLA (Jefe, División de Química), in *Revista de Agricultura de Puerto Rico*, Vol. VIII, No. IV, pp. 39-41. San Juan, June 1922.

The writer suggests that this plant, which is cultivated in all tropical and sub-tropical countries, is capable of great development in the island, especially for the manufacture of its starch which is very much in request for size. A short estimate is given of the cost of a small factory for an output of 120 qx. of starch from 600 qx. of manioc every 24 hours.
P. C.

- 1101 - **The Value of Ohio Wheats for Bread-Making.** — CORBOULD, M. K., in *Bulletin of the Ohio Experiment Station*, No. 350, pp. 187-219, with several figs. Worster, Ohio, June 1921.

The spring wheats grown in Ohio belong to the hard variety and are suited to the climate of the Northern part of the State. The winter wheat is subdivided into hard, semi-hard and soft types. The hard winter wheat flour has a high gluten content and is suitable for bread-making, the semi-hard flour is also recommended for the same purpose and cake and pastry-making. The soft winter flours must be blended with a stronger kind, if used for bread-baking, but are very suitable for all other baking-purposes.

The author gives the names of the soft and semi-hard Ohio varieties of wheat which yield the smallest percentage of bran. Soft wheats usually produce a great deal of bran.

A comparison between the wheats grown by the Department of Agronomy at the Ohio Experiment Station has proved that the semi-hard wheats which produce good yields per acre and give general purpose flour are best for Ohio growers.

Musty flour, if free from odour, may be used for bread-making. The flour of sprouted wheat has an improved bread-making quality, if the plumule has not grown longer than the kernel.
I. V.

- 1102 - **Manioc Bread.** — GUABRADO, G. A. (Laboratorio de Investigaciones, Sanidad, Habana), in *Sanidad y Beneficencia* Vol. 27, No. 3-4, pp. 145-146. Havana, March-Apr. 1922.

Manioc ("yuca") grows wild in Cuba, where it resists the most severe drought. It supplies the aborigines with bread, and for a quarter of a century has formed the chief food of the rural population of the island.

The starch content could be increased by scientific cultivation. The manioc is not well managed at present; for instance, the extraction of the starch is carried out in a primitive manner and a large amount remains in the pulp, also 450 000 kg. of starch and 225 000 kg. of glucose have to be imported annually into Cuba, whereas it should be possible to export these products on a large scale.

Dr. CALVINO, Director of the "Estación Agronómica Nacional" of Cuba has prepared bread and flat cakes of manioc containing 10 %

of wheat flour and has submitted them for examination to the Scientific Laboratory of Sanidad.

Manioc bread, externally, looks very much like that made from wheat, but, on account of lack of gluten, it is not so soft. It is slightly bitter but the taste is pleasant. It crumbles and moistens well during mastication. Like wheaten bread, manioc bread soon becomes stale, but its freshness may be restored by moistening and holding over a fire. The flat cakes are better than those made from wheat.

Regarding its nutritive value, the following Table gives the results of analyses; it should be stated that for the wheaten bread the figures given represent the average of 5 years analyses.

Analyses of manioc bread and wheaten bread.

	Manioc bread	Wheaten bread
Moisture	26.00 %	29.31 %
Protein (N X 6.25)	11.25	13.45
Starch and reducing sugars	49.11	54.42
Fats	8.60	1.18
Cellulose	4.00	0.63
Ash	1.04	1.00
Phosphoric acid in the ash	(0.074)	
Acidity calculated as acetic acid	0.40	1.40
Calories per Kg. of dry matter calculated according to the metabolic formula	4666	4081

If the use of manioc for making bread was extended, better utilisation of the plant would result. L. V.

1103 - **The Clarification of unfermented Fruit Juices.** — CALDWELL, J. S. (Plant Physiologist Office of Horticultural and Pomological Investigation), in *United States Department of Agriculture, Bulletin No. 1025*, pp. 1-30, bibliography of 33 works. Washington, January 23, 1922.

When unfermented fruit juice, such as that of apples or grapes, is prepared by the methods ordinarily employed, a more or less copious precipitate is formed after pasteurisation consisting of cellular debris and substances coagulated by heat. For this reason, a second pasteurisation is effected after an interval, and the formation of a coagulum in the final container is prevented, but the liquid remains permanently turbid and opaque from the presence of considerable quantities of suspended colloidal materials.

In the case of a few heavily pigmented varieties of grapes, the deep colour of the juices masks their turbidity and renders them attractive to the eye. The juices of most white grapes are too opaque to have an inviting appearance, and although their bouquet and flavour are often superior to the pigmented juices, their turbidity counts so heavily against them that no systematic attempts have been made to put them on the market, and they are little used even where pale-coloured grapes abound.

[1102-1103]

Unfermented apple juice, or "sweet cider", is to a large extent a seasonal product and consumed in considerable quantities in the autumn. Pasteurised unfermented cider has not gained greatly in popularity, the preference being given to synthetic drinks, pasteurised ciders being pronounced "muddy" and unattractive.

In view of the reception given to the clear attractive juices prepared by zealously guarded special methods, it is probable that the consumption of unfermented juices would be largely increased if simple and efficient methods of making brilliant transparent juices of unaltered beverage quality, were generally available.

To discover some such method was the object of the author's researches on apple and grape juice.

It was found that the ordinary filtration does not give satisfactory results when applied to apple, grape and grape-fruit juices, as they are difficult to filter and contain considerable quantities of colloidal material which passes through ordinary filters. Clarification by means of proteolytic enzymes is possible, but requires too much technical skill and supervision.

The addition of tannin and gelatine, casein, fish glue, egg-albumen and blood is unsatisfactory, for precipitation is slow and incomplete, the chemical composition of the juices is altered, and their palatability and flavour are affected. The preparation of a suitable silicic-acid gel is tedious and difficult and the precipitation obtained by its use is imperfect and slow owing to the clogging of the filters. Of the inert adsorbing agents, carbon is not suited for apple and grape juices as it removes flavouring substances, is a decolourising agent, and does not entirely remove pectins and gums, also, fine particles of carbon which pass through the ordinary filters remain in suspension and are finally deposited on the sides of the container. Diatomaceous earth is by far the most satisfactory aid to the filtration of fruit juices yet employed, for it removes the colloidal materials and leaves intact the colouring and flavouring substances. As obtained in the markets, diatomaceous earth contains varying amounts of wax derivatives which impart perceptible foreign flavours to most juices, but these objectionable materials are readily removed by heating the earth to redness for a short time. Earth that has been used may be "revivified" for future use by similar treatment.

The juice to be clarified should be allowed to stand undisturbed for 12 to 18 hours in order to permit the cellular debris to settle, and should then be siphoned, or decanted, from the sediment. The best results are obtained when the juice is thoroughly mixed with the diatomaceous earth at the rate of 6 to 8 pounds per 100 gallons and immediately filtered. During filtration, the juice on the filter must be well agitated at intervals to keep the earth in suspension and prevent obstruction of the filter.

The author describes the construction and operation of some simple but effective filters. For semicommercial operations he advocates a filter composed of a thick paste of diatomaceous earth supported by a nickel wire screen and a cloth; filtration is assisted by a suction pump. For household use, satisfactory results are obtained by gravity filtration

through a disk of earth somewhat thicker than the one described above. The vessel used should be at least 60 m. high and must be kept almost constantly full. Heating the juice before filtration has many advantages. If the heating is effected in open vessels or tanks, the temperature of the juice should not be allowed to exceed 130° or 140° F (44.5 — 60° C) nor should it remain long at this temperature in the case of apple juice or delicate grape juices as deterioration in flavour is easily produced. A few varieties of grape yield juices may be heated to 170° F (71° C) without injury.

By means of the above described process, preliminary pasteurisation and storage are eliminated; this shortens the process of preparation, decreases the losses, and improves the appearance of the product. Juices thus treated remain perfectly clear and transparent when bottled and pasteurised, and retain the characteristic flavour and quality of fresh juices.

I. V.

1104 — **Analyses of Italian preserved Fruits.** — ZAV, C. (R. Stazione chimico-agaria di Torino), in *Le Stazioni sperimentali agrarie italiane*, Vol. LX, No. 4-6, pp. 129-135, Modena, 1922.

The writer, being unable to find any analyses of Italian fruit preserve in the literature of agricultural chemistry, has analysed a series of preserves, jams and jellies of various fruits prepared by several Piedmont Firms.

The results (detailed in a tabular statement) show that the products of Italian industry do not differ essentially from those prepared in foreign countries, to which also they are in no way inferior.

F. D.

INDUSTRIES
RELATING
TO ANIMAL
PRODUCTS

1105 — **Studies on the Biology of Lactic Acid Bacteria.** — CORINI, C. (Laboratorio Bacteriologico della R. Scuola Superiore di Agricoltura, Milano), in *Journal of Bacteriology*, Vol. VII, No. 2, pp. 271-276. Baltimore, March 1922.

The author gives a short account of the studies he has made of recent years on the bacteria producing lactic acid; these micro-organisms include the lactococci and the lactobacilli.

LACTO-PROTEOLYTIC PROPERTY. — Many of these bacteria first coagulate and afterwards dissolve casein. Their action is checked by the addition of calcium or other substances, and depends upon certain factors of which one of the most important is *temperature*. As early as 1897, the author noticed that high temperatures promote the fermentation of lactose, whereas low temperatures are favourable to the proteolysis of casein.

He subsequently studied these processes more in detail. It appears that many bacteria when cultivated at 25°-35° C, show no lactic-proteolytic property, though this appears at 15°-20° C, i. e., the temperature maintained during the ripening of cheese. The composition of the medium is a matter of great importance. Thus even in 1902 the author observed that some bacteria dissolve casein but not gelatine, while others break up gelatine and leave casein intact, and certain species have a proteolytic action on both. The author also emphasises the injurious effect exerted upon proteolysis by the products of the process itself; these

[1103-1105]

are found in ordinary milk as a result of the great increase in the microorganisms before sterilisation. The *sterilisation method* is another important factor. If milk is sterilised at a high temperature, till it becomes brownish in colour, it can no longer be used for the demonstration of proteolytic properties; this explains the negative or almost negative results obtained by certain investigators.

BACTERIAL FLORA OF THE MILK DUCTS. — It has been shown that microorganisms are found on the udder, in spite of external cleanliness and healthy condition of the cow. This bacterial flora may be either useful or injurious both from the hygienic and dairy-industry standpoints. For this reason, the author made a selection of milch cows by the composition of their mammary flora and judged the quality of the milk yield according to the results of the fermentation tests.

HEAT RESISTANCE. — The author has proved that the non-sporiferous lactic acid bacteria resist temperatures of over 100° C owing to the formation of a protective layer of casein.

SPORE-FORMING BACTERIA. — The author isolated a *Bacillus acidicans-presamigenes-casci* present in cheese and also found a similar form in silage; and considers that spore-forming lactic-acid producing and acto-proteolytic bacteria are very wide-spread.

VISCOSITY. — The power of lactic acid bacteria to render milk viscid before making it acid has been observed by several investigators. The author recognises that this is a constant property of many bacteria which has passed unnoticed because it is transitory during the fermentation process.

APPLICATION TO THE CHEESE-MAKING INDUSTRY AND TO ENSILAGE. — Selected lactic acid bacteria assist the ripening of cheese by: 1) eliminating the putrefaction and gas-forming bacteria; 2) accelerating the maturation process. The same may be said as regards their effect upon ensilage. Lactic acid bacteria give very good results, especially if an impermeable bed is used, when the forage is half-dry, provided the air is excluded by so heaping up the silage, that the internal temperature rises to 35°-40° C. Inoculation gives excellent results particularly when the silage is not of a kind to set up spontaneous lactic acid fermentation.

Many of the author's results have recently been confirmed by other workers including BARTHEL, BOCKHOUT, DE VRIES, BURRI, ESTEN, KANS, HARDINGS, HARRISON, HOFFMANN, LÖHNIS, ORLA JENSEN etc.

J. V.

106 - Commercial Production of Butter in the United States. — See No. 1096 of this Review.

COMMERCE OF
PRODUCTS

PLANT DISEASES

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS

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|-------------------------------------|--|
| GENERAL | 1107 - Correlation between the Aluminium Content of Sugar Beet and Bacterial Infection. — See No. 1039 of this Review. |
| RESISTANT CROPS | 1108 - Various Plants introduced into the United States resistant to certain Diseases and Pests. — See No. 1031 of this Review. |
| PARASITIC DISEASES OF VARIOUS CROPS | 1109 - The Ascomycete <i>Ophiobolus cariceti</i> , as the Cause of Take-all of Cereals and Grasses. — FITZPATRICK, H.M., THOMAS, H.E., and KIRBY, R.S., in <i>Mycologia</i> , Vol. XIV, No. 1, pp. 30-37, figs 1, pl. 1. Lancaster, Pa., 1922. |

In July 1920, perithecia of a species of *Ophiobolus* were observed at East Rochester (New York) on wheat plants showing characteristic symptoms of the take-all disease, subsequently reported in various localities in the State and also elsewhere (1).

The fungus has been obtained in pure culture and repeated inoculations have shown it to be a specific agent of this disease.

This fungus, after comparative experiments made with material from America, England, Italy, France, Japan and Australia, has been classified as *O. cariceti* (Berk and Br.) Sacc.

A complete diagnosis of the parasite is given.

G. T.

- 1110 - Observations made in New York State on the Take-all Disease of Cereals and Grasses (*Ophiobolus cariceti*) (2). — KIRBY, R. S. in *Phytopathology*, Vol. XII, No. 2, pp. 66-68, figs. 3 pl. 3, bibliography of 31 works. Lancaster, Pa., 1922.

A survey made in 1921 in New York State demonstrated that the "take all" disease caused by *Ophiobolus cariceti* (Berk and Br.) Sacc. was present in nearly one half of the winter wheat fields of 16 counties in the west of the State. The disease was as severe as that described in Australia and Europe. The average damage in the 78 fields found infected in 1921 was about 2 % and the maximum damage in any one field was about 20 %.

The most typical symptom of the disease is a dwarfing of the host plant, which includes a reduction in height, in the number of tillers, in the number of heads, and in the size and amount of grain produced. The yield of an infected plant was on an average about 1 % that of a healthy plant.

(1) See R. Jan. 1921, No. 104. (Ed.)

(2) See No. 1109 of this Review. (Ed.)

The fungus is confined to the roots and lower internodes of the host, where a pronounced discolouration occurs. A typical plate of mycelium is found between the leaf sheath and the culm, and perithecia are produced in abundance, more than 100 having been found on single culms of wheat and *Agropyron repens*. As a result of inoculations under glass, typical perithecia were produced on wheat, barley, rye and one or more species of the following wild Gramineae:— *Agropyron*, *Bromus*, *Elymus*, *Festuca*, *Hordeum*, *Hystrix*, *Lolium* and *Phalaris*.

None of the 54 varieties of wheat tested in the greenhouse, showed any marked degree of resistance to take-all. These varieties included specimens of the following species: *Triticum sativum*, *T. compactum*, *T. burgidum*, *T. durum*, *T. dicoccum*, *T. Spelta*, *T. polonicum* and *T. monococcum*.

The causal organism was isolated and grown in pure culture on numerous media. Typical perithecia have been produced in pure cultures. In the present investigation seeds from infested plants did not act as carriers of disease. Soil from infected spots in the fields acted as a distributing agent for several months, but at the end of 8 months, soil which had been kept in the laboratory did not act as a carrier. Pieces of infected straw containing perithecia were very effective carrying agents; the virulence of the organism had not decreased at the end of 8 months.

G. cariceti requires a condition of alkalinity for optimum growth. This explains why the addition of alkaline substances to the soil has been observed to favour the spread of disease whilst the addition of acid-forming substances has the contrary effect.

The most promising methods of control seem to be: the practice of four to five year rotations; the eradication of wild gramineae and cross-fertilised cereals, which may act as hosts; discontinuation of the practice of digging in wheat stubble for 3 years preceding the sowing of wheat; cleaning the wheat seed thoroughly to remove all bits of straw which might carry perithecia; the discontinuance of the practice of liming the soil before sowing. Other suggested methods of control are late sowing and the use of resistant varieties, although definite results have not been obtained in either case.

G. T.

1111 - Moroccan Durum W heats liable to Rust. — See No. 1036 of this Review.

1112 - Diseases and Pests of the Olive Tree, in the United States. — See No. 1058 of this Review.

1113 - Diseases and Pests of the Cacao in Bahia, Brazil. — See page 1165 of this Review.

1114 - Leaf-Spot Disease of Tobacco caused by *Phyllosticta Nicotiana* in North Carolina. — WOLF, F. A., in *Phytopathology*, Vol. XII, No. 2, pp. 99-101. Lancaster, Pa., 1922.

For several years in succession, a leaf spot disease of tobacco has been noted in North Carolina, both upon seedlings in the nursery, and upon more mature plants in the field. Brownish spots are formed irregular

in outline, varying in size from 1 to 10 mm., lightest in colour near the centre, and bordered with pale or yellowish-green. Pycnidia of a *Phyll. lectica* (identified provisionally by the author as *Phyll. Nicotiana* R. and F.) are seen in the dead tissue.

The fungus has been isolated and grown in pure cultures and successful inoculations of seedling tobacco plants under glass have been made.

G. T.

1115 - *Soja max*, *Dahlia rosea* and *Cosmos bipinnatus*, new Hosts of *Bacterium Solanacearum*, in North Carolina. — WOLF, F. A., in *Phytopathology*, Vol. XII, No. 2, pp. 98-99. Lancaster, Pa., 1922.

In August 1921, specimens of *Soja max* sent from Columbus (N. Carolina), of *Dahlia rosea*, and of *Cosmos bipinnatus*, collected in Raleigh, were attacked by wilting, less marked in the case of the soybean, probably owing to the woody nature of the stems and petioles.

Upon microscopic examination of the xylem tissues, bacteria were observed; these were isolated from each host, and eventually identified as *Bacterium Solanacearum*, and according to the author the diseased condition of the three plants may be attributed to this bacterium.

G. T.

1116 - *Bacterium Solanacearum* injurious to various cultivated Plants in the Philippines (1). — WELLES, C. G., and ROLDAN, E. F., in *The Philippine Agriculturist* Vol. X, No. 8, pp. 393-398. 3 pl. Los Baños, Laguna, 1922.

The disease produced by *Bacterium Solanacearum* E. F. S. is one of the most serious of the maladies which attack the tobacco plant in the Philippines. It is common in all the tobacco-producing regions, and causes an annual loss of between 5 and 15 % of the crop; on seriously affected soil, 50 % of the crop may be destroyed. Although seedlings in the nursery are attacked as well as adult specimens, the plants that have been lately set out suffer most.

The disease also attacks the tomato and egg-plant on a large scale according to observations made near Manila and in the Province of Laguna. In the fields of the Los Baños College of Agriculture, 70 to 100 % of the tomatoes, egg-plants and tango plants (*Chrysanthemum coronarium*) were found to be suffering from the malady. Nearly all the tomato plants were killed while still young, the egg-plants arrived at the fructification stage, but none of the fruits ripened. *Chrys. coronarium*, like *Ricinus communis*, was attacked at all stages of development.

The disease is characterised by the more or less rapid and complete withering of the organs of the plant which unless it has reached an advanced stage, usually succumbs. Old plants although they wilt and wither manage to survive.

Numerous unsuccessful attempts to control this disease have been made at Los Baños. GARNER, WOLFF and MOSS state that the only

(1) See also R. Aug. 1922, No. 875. (Ed.)

remedy is a five-year rotation during which all the host plants of *Bact. Solanacearum* are rigidly excluded from the infected soil.

It has been found that the egg-plant suffers little from the disease if sown in the rainy season so as to ripen in December. G. T.

1117 - *Fusarium* sp., a *Deuteromycete* injurious to the Tomato Plant in North Queensland. — POLLOCK, N. A. R., in *The Queensland Agricultural Journal*, Vol. XVIII, Part. 1, pp. 10-12. Brisbane, July 1922.

Some five or six years ago, a disease due to a species of *Fusarium* was noticed for the first time in the Bowen district where the tomato is cropped annually over considerable areas. In this district, the disease is of general occurrence and few areas even on virgin soil are free from the infection.

The disease has also been observed at Townsville and Cooktown, but it does not seem to exist in other areas where tomatoes are grown for market such as Guthalungra, Gumlu, Cloncurry, Charterstown, Cape-River etc.

The fungus attacks the roots and spreads through the fibro-vascular tissue which when cut in sections is seen to be brownish. The first indication of attack is usually the yellowing of one or more of the bottom leaves followed by the wilting of one or several branches. Where the plant has no tap-root, one branch is usually first affected followed later by others, until ultimately the whole plant dies. The period from the first sign of attack to the death of the host, varies according to its power of resistance and the severity of the infection, so that the plant may die at once or linger on for several weeks.

It is possible that the disease may extend to the fruit, but no external or internal signs of its presence have hitherto been detected.

The disease sometimes shows itself a few weeks after the plants have been set out; it is usually not found in those left in the seed-bed even if they have been neglected.

Self-sown plants appearing in fields where tomatoes were grown the previous season frequently show no signs of infection. One case of the serious infection of self-sown plants has been observed, but the land was sown with another crop, and probably some damage was done to the tomato-roots during cultivation.

While so far no variety of tomato has proved immune, some varieties are more resistant than others. Early maturing varieties such as "Chalk's Early Jewel" appear more subject to the disease than the main crop varieties.

No data are available as to the length of time the fungus may retain its vitality in the soil in the absence of any plant host, but there is abundant evidence that the infection increases when tomatoes are grown in succession upon the same ground.

It has been noted that the fungus spores were probably carried by the seed in the first instance, but when diseased and healthy plants are set out together, the disease can be contracted through the soil.

It is clear that the fields on which diseased plants have grown can carry infection, and that it may be transmitted to other fields by implements or other mechanical means.

The disease may also make its appearance on the roots, but the author is of opinion that the fungus generally enters by means of lesions due to want of care in lifting young plants in the nursery, or inflicted by different tools etc.

An experiment was carried out in this connection; when setting out the plants their roots and stems, as far as the bottom leaves, were dipped in a solution of 1 part copper sulphate to 500 parts by weight of water with a view to sterilising the broken rootlets; at the same time they were watered with a similar or weaker solution. Although complete immunity was not gained, the treated plants were longer in developing the disease than the untreated.

The author believes that crop rotation is the chief factor in the control of this disease. Sweetening of the soil by liming, and increasing the amount of plant food by the application of fertilisers to insure vigorous growth are necessary processes. In addition to the foregoing and equally important are the raising of disease-resistant strains and careful attention to seed selection.

G. T.

1118 - *Cercospora Melongena*, n. sp. of Hyphomycete injurious to Egg Plant in the Philippines. — WELLES, C. G., in *Phytopathology*, Vol. XII, No. 2, pp. 61-65, figs. 2. Lancaster, Pa., Feb. 1922.

A spotting of the leaves of the egg plant has been observed recently in Los Paños, Laguna Province (Philippine Islands), especially on the lowest and oldest leaves. Chlorotic irregular shaped spots, frequently fusing, appear first on the upper surface of the leaf, later reaching the under surface. With age, the central portions of the lesions, which may cover an area of 6 to 8 mm. dry up and turn greyish-brown and show concentric rings. In advanced stages of spotting, the dead tissues fall out leaving a shot-hole effect.

According to the author the agent responsible for this disease is a new species of *Cercospora* which he describes and names *C. Melongena*.

The native variety of egg plant has a long black fruit, turning yellow when ripe, and this has been seriously damaged by this disease, while the Siamese variety, small round and yellow fruit, is but slightly affected. All the plants in the district where the disease was first notified were infected, with from 50 to 100 % of the leaves attacked.

Several experiments have shown that spraying with Bordeaux mixture every two weeks is sufficient to hold the disease in check. However, comparison between sprayed and unsprayed plants has shown no important difference as regards setting or development of fruits. On the other hand, spraying tends to increase longevity of leaves and the general vitality of the plants. From these results it seems that spraying is not justified from the commercial standpoint for mature plants, unless the disease threatens to be unusually severe resulting in serious defoliation. Should

this occur, especially with young leaves or seedlings, spraying may be relied upon as a control measure.

G. T.

1119 - **Banana Freckle (*Phoma Musae*) in the Philippines.** — LEE, H. A., in *Phytopathology*, Vol. XII, No. 2, pp. 101-102, figs 1. Lancaster, Pa., 1922.

On both green and ripe bananas in the public markets in the Philippines, sometimes dark reddish-brown and sometimes black, minute distinct and hard spots were noticed. Usually they occur in large numbers and in some cases in masses on the fruits. Similar spots are seen on the leaves, but rather more streaked.

The varieties known locally as Latundan, Borongan, Lacatan and Saban of *Musa Sapientum* are affected.

Examination of the spots shows the presence of pycnidia and spores which resemble very closely those of *Phoma Musae* Carpenter, previously reported in the Hawaiian Islands as the cause of the "banana freckle."

The disease is much more abundant at the close of the wet season than during the dry season. As bananas in the Philippines are grown entirely for local consumption, the disease here does not cause the loss which occurs in the banana industry in Hawaii.

It has recently been reported that this disease is widespread in the Sulu Archipelago, and in the Island of Mindanao in the Philippines. These islands are sparsely populated, and no bananas have been imported from the western hemisphere which indicates that the banana freckle is indigenous or at least has existed a long time here.

There is a continual migration of labour from the Philippines to the sugar plantations of Hawaii, and it may be supposed that a few infected fruits have been introduced in this way into the banana plantations of Waipili Valley, adjoining Honolulu, where the disease was first reported or Hawaii.

G. T.

120 - ***Penicillium expansum*, Stem End Rot of Apples, in California.**

BARNUM, C. C. in *Science*, new series, Vol. LV, No. 1135, pp. 707-708. Utica, N. Y., June 30, 1922.

During the late spring of 1921 a large number of apples which came from a lot removed from a cold storage temperature of 32° F and kept for a few days at 45° F, started to decay at and around the base of the stems. When placed in a moist chamber, these apples very soon decayed without wrinkling, becoming soft and watery. Decay was of a sharply defined nature and the affected parts could be easily removed. Normally these decayed apples were soon covered with green mould. On examination of the stems of apples in storage it was found that many were green as the result of fungus conidia, which after cultivation were identified as *Penicillium expansum* Lk.

No mention is made in the literature of the subject as to the entrance of a decay-producing organism through the stem. The decay of apples, which is ordinarily caused by *P. expansum*, is invariably mentioned in connection with abrasions of the skin, such as insect punctures and wounds or injuries of a mechanical nature. Some authors refer to infection as

entering through the calyx, but no-one has ever notified stem end infection.

During the autumn of 1921, large mature Yellow Bellefleur apples were collected from trees in a Berkeley garden. These were picked with the fruit spurs attached, carefully washed in alcohol, mercuric chloride solution 1-1000 and distilled water, consecutively. The leaves were clipped from the spurs to facilitate the process, but the spurs were not removed. Moist chambers were sterilised and prepared, the spurs were then removed from each apple and conidia of *P. expansum* were applied to the freshly exposed surface at the ends of the fruit stems, and the apples were then placed in the moist chambers. Control fruits similarly treated, but not inoculated, were kept under the same conditions in the laboratory. Of the six apples thus treated four developed the characteristic stem rot and were soon completely decayed. The control apples remained in good condition for 3 months.

Yellow Newtown apples were picked in the same manner at Watsonville (California), and brought to Berkeley. On October 17, 1921, three of the ripest of these apples were treated and inoculated in the same way as the Yellow Bellefleur specimens. On November 18, the form of decay of all three apples was identical with that observed on fruits naturally infected. Six Yellow Newtown apples were treated in the same manner and inoculated with the same organism several days later than the previous group, and they all showed signs of the typical decay. In every case the controls remained in good condition. After six weeks all the apples inoculated were entirely decayed and covered with green conidia. Cultures of these Conidia appeared identical in every way with the original culture. Further inoculations were made with re-isolated cultures on carefully sterilised apples. At the same time other apples were inoculated with the original culture. Results were identical, the typical *Penicillium* decay showing itself at every puncture. A *Penicillium* isolated during the autumn of 1921 from decaying plums was found to give rise to typical decay in apples after inoculation. This plum *Penicillium*, inoculated into the stems of three Yellow Newtown apples caused typical stem end decay after three weeks. The same *Penicillium* was found later to be identical with the original *Penicillium* isolated from apples.

Preparations were made from the infected leaves on some of the apples used in the experiments and typical colonies of *P. expansum* were developed. About 15 % of the colonies were identified as belonging to the *Penicillium* species; a considerable number were responsible for typical *P. expansum* decay when inoculated into ripe apples. This fact would seem to indicate the abundance of the fungi in the trees at harvest time.

These results prove that stem end infection of apples is possible. Observations made by the author indicate that this mode of infection is quite common among apples in California, especially on Yellow Newtowns. Although checked by cold storage, the rot makes some progress at a temperature of 45° F and at room temperature decay is rapid.

G. T.

121 - Observations on the Erysipheae *Microsphaera quercina*, *Sphaerotheca mors-uvae* and *Oidium farinosum*, in Italy. — TROTTER, A., in *Annali della R. Scuola superiore d'Agricoltura in Portici*, Vol. XVII, pp. 3-11 (extract). Portici, 1922.

Microsphaera quercina (Schw.) Burr. — On the upper surface of oak leaves collected between the 20th and 30th of November 1920 at Zaffaria Province of Messina (Sicily), which were covered with the characteristic "oidium", the writer noticed some perithecia of *Micr. quercina*, previously found in Italy, in the Province of Bologna (1) and at Rome (2).

Sphaerotheca mors-uvae (Schw.) Berk. and Curt. — This Erysiphea reported as found for the first time in Italy in 1914 (3), had, however, been previously observed in August 1904, at Tornetti di Vih, in the Province of Turin. From 1912, the writer had found it in the Province of Avellino (Celsi, Forino and Avellino), where it may have been introduced by means of infected plants of *Kibes* coming from Northern Italy. At the present time the presence of the fungus is certain in Piedmont (Province of Alessandria (4), Novara (4) and Turin), in Lombardy (Milan and Pavia) (5), in Venetia and in Campania (Prov. of Avellino).

Oidium farinosum Cooke. — On apple trees grown in the nurseries of the Royal School of Oenology and Viticulture at Avellino, an extensive attack of *Oidium farinosum* has been observed for several years, taking place in spring. The fungus had been only recently reported in Italy, and especially in Northern Italy, whence it may have reached Avellino in young wild apple plants. This conidial form — which, according to the writer, should be attributed, in the present case, to *Podosphaera encotricha* (Ell. and Ev.) Salm. — shows a great tendency to propagate itself, especially on young nursery plants, the buds of which are attacked to such a degree that they die and dry up in a very short time. According to the writer, wild plants, obtained from seed and not yet grafted, were all more or less badly attacked, while the grafted plants had vigorous grafts, with buds almost entirely unharmed.

G. T.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

22 - Observations on the Coccidae of Egypt. — HALL, W. J., in *Ministry of Agriculture, Egypt, Technical and Scientific Service, Bulletin* No. 22, pp. 1-51, pl. 3. Cairo, 1922.

GENERAL

A record of the fifty-six species of Coccidae of Egypt to be found in the collections of the Ministry of Agriculture. It is probable that over a hundred identified species exist in the country, and doubtless some new species will be collected, when it is found possible to make a detailed examination of the desert flora as a whole.

A brief description is given of the external characters of the species

(1) See R. Feb. 1920, No. 264. (Ed.)

(2) See R. May 1921, No. 508. (Ed.)

(3) See R. Dec. 1914, No. 1188. (Ed.)

(4) See R. July 1922, No. 785. (Ed.)

(5) See R. Dec. 1914, No. 1188. (Ed.)

enumerated with references to any peculiarities. The microscopic characters are only mentioned when the preparations made by the author show any distinct divergence from type. Information is added as to bibliographical sources in which will be found descriptions and illustrations of the various species. A complete list of the host plants is also given, and in the case of species which have proved recognised pests, certain observations are made as regards the outbreak and the control measures adopted, including the legislative orders.

In the appendix, a short list of the Coccidae collected in Palestine at the end of 1921, is given.

G. T.

INSECTS, ETC.
INJURIOUS
TO
VARIOUS
CROPS

1123 - *Vespa germanica* and *V. vulgaris*, Hymenoptera injurious to the Ghesab (*Pennisetum spicatum*) in Sicily. — See No. 1056 of this Review.

1124 - *Calligrapha exclamatoris* and *Mordellistina pustulata*, Beetles, Injurious to *Helianthus* spp. in Manitoba, Canada. — CRIDDLER, N., in *The Canadian Entomologist*, Vol. LIV, No. 5, pp. 97-99. Orillia, May 1922.

The recent cultivation of sunflowers (*Helianthus* spp.) for fodder purposes has provided a new instance of hitherto harmless insects becoming pests.

In Canada a large number of wild species of sunflower are found some of which are closely allied to the cultivated kinds and as the wild varieties have their insect enemies there is no reason why these should not spread to those under cultivation and thus become of economic importance.

The sunflower-leaf beetle (*Calligrapha exclamatoris*), is a very common and widespread insect in Manitoba where it is found feeding upon the leaves of various species of wild sunflower. It seems to live exclusively on *Helianthus*, and for that reason, promises to be one of the most important insects attacking this plant. The beetle has already spread to cultivated sunflowers on which it breeds as rapidly as upon the wild kinds. The author gives a morphological and biological description of the different stages of the insect; both beetle and larvae feed upon the leaves of sunflowers. In nature, they are most frequently met with on perennial species such as *Helianthus giganteus*, though they have been noted in numbers upon *H. annua petiolaris* also, and from this have spread to cultivated species.

There is but one generation of the insect in Manitoba. The adult form superficially resembles the Colorado potato beetle (*Leptinodarsa decemlineata*), but is considerably smaller. Sprays similar to those used for the latter pest are also effective against the Sunflower beetle.

The larvae of another beetle, *Mordellistina pustulata*, were first collected from the stems of the Red-root Pigweed (*Amaranthus retrofractus*), which had prematurely died. Later, they were found hibernating in sunflower stems some of which they had riddled with their tunnels. These larvae confine themselves largely to the pith, but also injure the more woody parts; they occur most frequently near the base of the plant, al-

though any portion of the stem may be infested. Plants thus injured have a stunted appearance and sometimes die. Several larvae may infest a single stem and these remain within the plant until the following spring when they pupate; the adult beetles make their appearance in June. A description is given of the morphological characters of the larva and of the adult beetle.

In addition to the beetles mentioned above, a weevil, *Desmoris contractus*, has been found feeding on the flowers of *Helianthus*, but it remains to be seen whether it will become of economic importance. G. T.

125 - *Pyrausta penitalis* — a Microlepidopteron parasitic on the Nymphaeaceae, *Nelumbo lutea* and *N. nucifera* in the United States. — ANSLIE, G. G. and CARTWRIGHT W. B., in *United States Department of Agriculture, Bulletin* No. 1076, 14 pp. pl., 1. Washington, D. C., July 1922.

Pyrausta ainsliei Heinrich (1) and *Pyr. penitalis* Grote are two closely related species very similar in many morphological and biological characters to the maize borer (*Pyr. nubilalis* Hübn) (2) recently introduced into America from Europe. It therefore seemed possible that a close study of the life-history and habits of the two native species might bring to light some facts that would help to determine the potentialities of the new pest.

In order to make the habits of the American species better known a paper dealing with *P. ainsliei* from the biological standpoint, has already been published; the present paper treats of the life-history, habits and enemies of *Pyr. penitalis*.

The authors' work dates from July 1919, and was carried out at Kimberlin Heights and Knoxville in Tennessee where the Microlepidopteron was chiefly studied on the yellow lotus (*Nelumbo lutea*); this Nymphaeaceae and *N. nucifera* are as far as is known at present, the only natural hosts of the insect.

The larvae feed on the leaves of *N. lutea* which is grown as an ornamental plant and not only destroy them, but also attack and deform the pods, thus spoiling many of the seeds.

In confinement in the laboratory the partly grown larvae found on lotus fed readily and completed their development on smartweed (*Polygonum pennsylvanicum*), buckwheat (*P. fagopyrum*) and dock (*Rumex crispus*). G. T.

26 - The Banana Weevil (*Cosmopolites sordidus*), injurious also to Abaca (*Musa textilis*), in the Philippines. — CENDANA, S. M., in *The Philippine Agriculturalist*, Vol. X, No. 8, pp. 367-376, pl. 3. Los Baños, Laguna, 1922.

Although reported first in the Philippines only twenty to thirty years ago, *Cosmopolites sordidus* Germ. judging from its wide distribution, was certainly in existence before that time, and has been the cause of serious losses both of banana and abaca plants (*Musa textilis*). In 1916 this coleopteron killed large numbers of banana and abaca plants in Pacte, La-

(1) See R. July 1921, No. 783. (Ed.)

(2) See R. May 1921, No. 585. (Ed.)

guna Province. To-day the Pacte abaca industry is practically ruined.

The insect is a serious pest throughout the Philippines, and attacks banana plants of all varieties and at all stages of development. Most of the injury is done to suckers of the size best suited for transplanting, that is, from 75 cm. to 1.5 m. high.

The first outward indication that a sucker has been attacked is its loss of vigour. As the attack continues the unopened leaves die and fall off. If the sucker is removed and sliced through, the bulb is found to be riddled with holes, tunnelled out by the weevil. The older suckers are not killed as a result of attack, but are so weakened that the flowers produced are abnormally small. Observations made at the College of Agriculture, Los Baños, indicate that the small and medium sized varieties of banana are more liable to attack than the larger varieties. Further experimentation is however, necessary. The abaca appears on the other hand to be less readily attacked than the banana; here again further experiments are needed.

Detailed information is given as regards the habits and life history of the insect.

The insect is undoubtedly distributed by the transportation of infested suckers and root stocks for propagating purposes. The beetle rarely flies, but is able to crawl along the ground and can cover at least 15 metres each night.

No natural enemies of *C. sordidus* have been discovered in the Philippines, where amongst other control measures tried, infested suckers have been soaked for varying lengths of time in water and in formaldehyde solutions of different strengths. It was found that formaldehyde has a negligible effect on the vitality of the insect. In water the larvae and pupae from both bananas and abacas died within 72 hours, and only in a few cases were the larvae found dead after 48 hours. The adults however appeared to survive and usually crept to the part of the suckers above water, and can thus in most cases be readily collected and killed.

The stools cut during the harvest should not be left in the fields as they would harbour the beetles and act as a breeding ground.

Plantations should as far as possible be kept in good condition and very old plantations should be cut down and the land ploughed. Crop rotation is also advised.

G. T.

1127 - *Tetranychus yothersi*, a Mite Injurious to the Avocado and other Plants in Florida. — MOZNETTE, G. F., in *United States Department of Agriculture, Bulletin No. 1035*, 15 pp., figs. 11, 1 coloured plate. Washington, D. C., 1922.

The red spider, *Tetranychus yothersi* Mc.G., was recognised as a formidable enemy of the avocado (*Persea gratissima*) in Florida as early as 1909, since which time the damage caused by it has increased each year.

In groves where the red spider abounds, the trees frequently become defoliated prematurely during the winter season. This generally results in an abnormal development of bloom the following spring, and the weakened trees are unable to set and hold a full crop of fruit.

[1126 1127]

The red spider punctures the leaves and sucks the contents forming white spots at the point of attack; later, the leaf becomes red and appears scorched. The foliage so attacked soon falls.

T. yothersi, which was first named and described from specimens on the leaves of camphor (*Cinnamomum Camphora*) sent from Florida, has been found by the author on both the West Indian and Guatemalan varieties of *P. gratissima*. It occasionally causes considerable injury to the mango (*Mangifera indica*), Camphor (*C. Camphora*) and the Australian silk oak (*Grevillea robusta*) in Florida. It has also been collected there on *Eucalyptus* sp., *Terminalia Arjuna*, *Anona squamosa*, *Cucumis sativus* and *Icacorea paniculata*.

In S. Carolina, the pest has been found on *Ulmus* spp. *Salix* sp., *Quercus alba*, and *Hicoria Pecan*; and in N. Carolina on *Ulmus* sp.

A description is given of the life-cycle, habits and biology of the mite.

The following predatory enemies attack *T. yothersi*; *Scholothrips sexmaculatus* Pergande, *Chrysopa lateralis* Guer., *Scymnus utilis* Horn, *Sc. Fenzli* Casey, and *Leptothrips mali* Hinds: of these *Sc. utilis* is the most formidable.

Several insecticides have been successfully used against the avocardo red spider: finely powdered sulphur, lime-sulphur spray, commercial sodium sulphide, and nicotine sulphate containing 40 % nicotine.

Dusting with powdered sulphur is by far the quickest method and would be very practical, but for the fact that the presence of other insect pests in addition to red spider necessitate the use of liquid insecticides.

During the winter, after the fruit has been gathered it is advisable to apply a lime-sulphur solution in the proportion of 1 gallon of concentrated solution to 60 gallons of water. When the temperature is above normal, or when the trees do not attain a thoroughly dormant condition, 1 gallon of the concentrate to 75 gallons of water can be used.

Sometimes the mites make their appearance in the autumn before the fruit is picked. At this season, a 40 % nicotine sulphate spray (in the proportion of 1 part to 900 parts of water) with the addition of 2 or 3 pounds of fish-oil soap to each 100 gallons of the diluted spray, is temporarily effective and does not spoil the fruit.

The spray rod and spray gun have both been used in these operations, but it was found that the latter gave more satisfactory results.

Orchards mulched in various ways are generally less infested with red spider in South Florida than those where clean culture is practised. The avocardo, however, seems to thrive best where mulching is carried out and the moisture is conserved.

One factor largely influencing the appearance and abundance of red spider in a grove is the vitality of the trees. Nothing is to be gained by allowing trees to suffer from want of proper attention such as mulching, fertilisers and culture.

G. T.

[1127]

1128 - The Beetle, *Ips Pini* as a primary Pest of *Pinus divaricata* and *P. resinosa* in Minnesota. — GRAHAM, S. A., in *The Canadian Entomologist*, Vol. LIV, No. 5, pp. 99-100. Orillia, May 1922.

Although it has been generally established that *Ips pini* Say is normally a secondary parasite, and usually attacks only dead or dying trees, this beetle has also been known to kill healthy trees as actually occurred in Itasca Park during the summer of 1921. The specimens destroyed were ten in number; 7 being young, rapidly growing Jack pines (*Pinus divaricata*), varying from 2 1/2 to 5 inches in diameter on the stump, and 3 healthy Norway saplings (*P. resinosa*) about 15 years old.

Each of these trees was very heavily infested from the surface of the ground almost to the top by the first brood beetles, and must have been attacked simultaneously by a large swarm of the insects. Apparently the attack was concentrated upon the few trees killed, since a careful examination of surrounding pines failed to show any signs that other individuals had been infected. Probably the beetles were attracted by the presence of two freshly felled pines which had been seriously infested. So large a number of the insects were present that many were forced to find quarters in the standing trees near.

It is a curious fact that the beetles did not infest the large piles of recently-sawn pine-logs of which there were many in the neighbourhood. The small group of heavily infested trees were quickly discovered by wood peckers which destroyed at least 90 % of the insects, both adult and larvae, thus preventing the attack from assuming serious proportions.

Although the felled trees lying on the ground which the author assumed to be the attraction, harboured quite as many of the insects as the standing trees, it is interesting to note that the woodpeckers did not work at all on these trees.

This fact would appear to show that considerable care must be exercised in the use of trap trees for bark beetles. It is believed that the insects can be attracted by trees that have recently been killed and are known as trap trees. After they have become infested, they can be destroyed, thus materially reducing the number of insects in the forest. The presence of newly killed trees in the neighbourhood of freshly cut logs clearly shows that trap trees, as they appear to have a tendency to concentrate the beetles, must only be used with the greatest caution. G. T.

[1128]